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MOLECULAR SIEVE TESTS FOR CONTROL OF NOx EMISSIONS FROM A NITRIC ACID PLANT

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MOLECULAR SIEVE TESTS FOR CONTROL OF NO_x EMISSIONS FROM A NITRIC ACID PLANT

Volume II - Appendices

Industrial Environmental Research Laboratory
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16. ABSTRACT

The report gives results of performance testing for NOx emission control on Union Carbide's PuraSiv N unit, now controlling emissions from the tail gas stream of the ammonia oxidation nitric acid production facility of Hercules, Inc. in Bessemer, Alabama. Simultaneous measurements of NO2/NOx concentrations were performed in the PuraSiv N inlet and outlet streams during 11 individual 4-hour adsorption cycles, using continuous photometric analyzers. NOx concentrations were also measured at the test sites, using the EPA Method 7 reference procedure, to provide comparative data. Total NOx mass loading to the sieve was variable from cycle to cycle, ranging from 63,370 to 251,800 grams, reported as NO2. Average efficiency of the control unit for the cycles tested ranged from 98.68 to 95.92%. The integrated average concentrations of NOx emitted over the complete cycles ranged from 17 to 154 ppm.

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Nitric Acid	Stationary Sources	07B
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VOLUME II--APPENDICES

by

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APPENDIX A

DATA REDUCTION TECHNIQUE AND EXAMPLE CALCULATIONS

INSTANTANEOUS SIEVE FLOW RATES AND NO_X CONCENTRATIONS FROM REDUCED STRIP CHART DATA WITH CALCULATED MASS FLOW RATES, MASS LOADINGS AND CONTROL EFFICIENCIES

APPENDIX A

The outputs of the UV-visible photometric analyzers used to measure the inlet and outlet NO_2 NO_x concentrations were recorded on strip chart recorders. Separate recorders were used for each of the test sites. Figure A-1 is a copy of the recorded instrument output for inlet test site HV-23 during the first 115 minutes of test 11. Figure A-2 is a copy of the recorded instrument output for outlet test site HV-13 during the same period. Both copies provide the basis for example calculations in this section.

A data reduction technique was used to provide instantaneous sieve inlet and outlet NO_x concentrations at appropriate intervals suitable for application of the trapezoidal rule for integration. The major assumption in the integration method is that concentration changed linearly between the endpoints of an interval, thus it was required that the points defining the intervals be carefully selected. The following method was used for reducing the strip charts.

1. The nearly continuous strip chart records of inlet and outlet NO_2 measurements were converted to continuous form using linear interpolation in order to provide an estimate of the NO_2 concentrations which existed while the analyzers were being operated in either the NO_x or zero modes. First, the zero drift which occurred during the intervals between zeroing of the instruments was distributed over each interval using linear interpolations. The technique was applied by drawing a straight line on the strip chart between the points where the zero baseline was established. This provided an estimate of the instrument zero baseline at any point in time. Second, the NO_2 measurements which were missed as a result of switching the instruments to the NO_x or zero modes were approximated by drawing straight line on the strip chart between points where the NO_2 measurements terminated and started again. Examples of the distribution of zero baseline drift are found between 0700 and 0905 on Figure A-1 and between 0700, 0758

FIGURE A-1. EXAMPLE OF RECORDED NO_2/NO_x STRIP CHART DATA
(FIRST 115 MINUTES OF TEST - 11, INLET SITE HV-23)

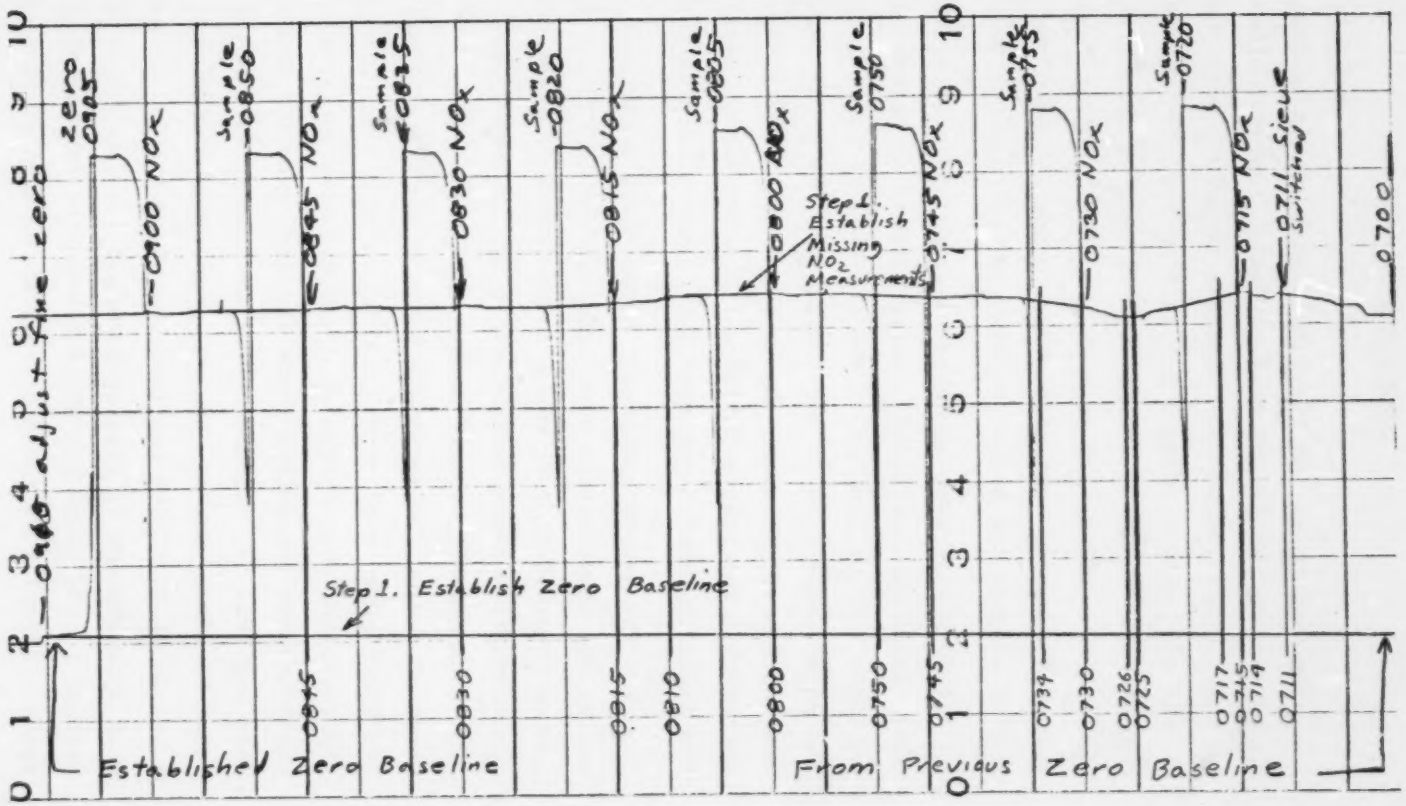
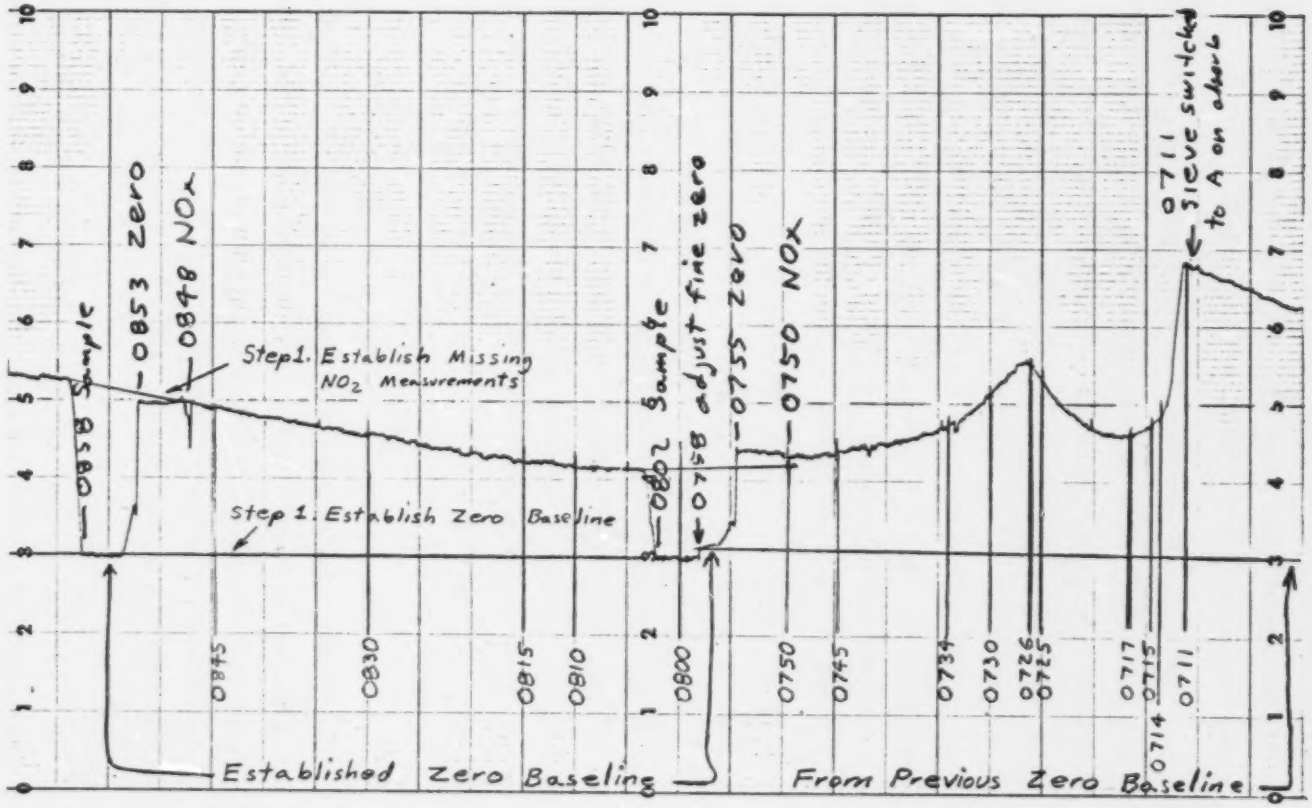


FIGURE A-2. EXAMPLE OF RECORDED NO_2/NO_x STRIP CHART DATA (FIRST 115 MINUTES OF TEST - 11 OUTLET SITE HV-13)



and 0853 on Figure A-2. Examples of the estimation of NO_2 measurements during periods when the analyzers were either in the zero or NO_x mode are found from 0715 to 0720 and 0730 to 0735 on Figure A-1 and from 0750 to 0802 on Figure A-2.

2. Points were selected for reading NO_2 concentrations from the recorded charts at appropriate intervals for use of the trapezoidal rule. The points selected included, but were not limited to all points which corresponded to the beginning of each NO_x measurement. Each point was carefully selected so that the contour of the strip chart trace could be approximated by a series of straight lines connecting the points. The location of points selected in the example are identified by vertical lines with corresponding times drawn on the strip charts.

3. For each point selected on the strip chart traces, the time and the percent of chart values for the zero baseline and NO_2 measurements were determined and copied on to a data reduction worksheet. Figure A-3 is a copy of the data reduction worksheet used for test 11. The times corresponding to each point appear in column 2. NO_2 percent of chart values for the inlet trace appear in column 3 and the zero baseline values in column 4. Outlet NO_2 and zero baseline percent of chart values appear in column 9 and 10 respectively.

4. The difference between each NO_2 percent of chart value and the corresponding zero baseline value was calculated. These values appear in columns 5 and 11 on the worksheet. NO_2 concentrations were calculated using the appropriate range factors. For the inlet instrument, the factor was 50 ppm of NO_2 per percent of chart, for the outlet instrument the factor was 5 ppm of NO_2 per percent of chart.

5. The percent of chart values for each of the NO_x measurements and the corresponding zero baseline values were determined and copied onto the worksheet. The NO_x determinations on the worksheet are identified by the mode identification in column 1. For

FIGURE A-3. EXAMPLE DATA REDUCTION WORKSHEET

TEST - 11

DATE 3/14/75 HERCULES INC., RUN 11, INLET :IV-23, OUTLET HV-13 UNIT A 0711-1114

Column	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
									OUTLET										
Mode	Time	Trace % of Chart	Baseline % of Chart	Difference	Ppm NO_2	Ppm NO_x	% NO_2	Trace % of Chart	Baseline % of Chart	Difference	Ppm NO_2	Ppm NO_x	% NO_2	Elapsed Time	Inlet Flow	Reactor Flow	Ppm NO_x In	Ppm NO_2 Out
NO_2	0711	63.75	20.0	43.75	2188		65.4	68.25	30.25	38.0	1900			0	5500	1020	3340	190
NO_2	0714	63.5	20.0	43.5	2175		65.4	48.5	30.5	18.0	900			3	5500	1020	3320	90
NO_2	0715	64.0	20.0	44.0	2200		65.4	47.0	30.5	16.5	82.5			4	5500	1015	3360	82
NO_x		87.25		67.25		3362												
NO_2	0717	63.0	20.0	43.0	2150		65.0	46.0	30.5	15.5	77.5			6	5500	1015	3310	78
NO_2	0725	61.0	20.25	40.75	2038		63.2	53.0	30.5	22.5	112.5			14	5475	1020	3220	112
NO_2	0726	61.0	20.25	40.75	2038		63.0	55.25	30.5	24.75	123.75			15	5475	1020	3220	124
NO_2	0730	62.25	20.25	42.0	2100		62.0	51.0	30.75	20.25	101.25			19	5450	1020	3380	101
NO_x		88.0		67.75		3388												
NO_2	0734	63.0	20.25	42.75	2138		63.1	47.0	30.75	16.25	81.25			23	5450	1020	3390	81
NO_2	0745	63.75	20.5	43.25	2162		65.8	43.75	31.0	12.75	63.75			34	5475	1020	3290	64
NO_x		86.25		65.75		3288												
NO_2	0750	64.0	20.5	43.5	2175		66.3	43.25	31.0	12.25	61.25		98	39	5475	1020	3280	61
NO_x								43.50		12.50		62.5						
NO_2	0800	64.5	20.5	44.0	2200		67.4	41.5	30.0	11.50	57.50			44	5475	1020	3260	58
NO_x		85.75		65.25		3262												
NO_2	0810	64.0	20.5	43.5	2175		68.0	41.5	30.0	11.50	57.50			59	5475	1020	3200	58

the inlet test site, the NO_x measurements were made approximately every ten minutes for five minute intervals. On Figure A-1 the beginnings of the NO_x measurements occur at 0715, 0730, 0745 and 0800. The percent of chart values on the worksheet appear in columns 3 and 4 below the NO_2 values for the same times. For the outlet test site, the NO_x measurements were made approximately once an hour due to the absence of NO in the outlet stream. On Figure A-2 the beginning of an NO_x measurement occurs at 0750. The percent of chart values for the NO_x measurements were read at the end of each 5 minute NO_x determination, after the complete oxidation of NO to NO_2 in the sealed sample cell had occurred.

6. The difference between each NO_x percent of chart value and the corresponding zero baseline value was calculated, and the NO_x concentrations were determined in the same manner as in step 4. The different values appear in columns 5 and 11, and the concentrations appear in column 7 and 13 on the worksheet.

7. The percent NO_2 in each NO_x measurement was calculated from the ratio of the NO_2 measured at the beginning of each NO_x measurement to the NO_x measured. The calculated percents appear as the circled values in columns 8 and 14 on the worksheet. The percent NO_2 for each point where no corresponding NO_x measurement existed was calculated by interpolating between known NO_x percent values. For the inlet test site, the calculated values appear as uncircled values in column 8 of the worksheet.

8. The inlet NO_2 concentrations which appear in column 6 on the worksheet were converted to NO_x concentrations using the calculated percent NO_2 in column 8. The calculated values for the inlet appear in column 18. The outlet NO_x concentrations appearing in column 19 were calculated from the outlet NO_2 concentrations in column 12 using an NO_2 to NO_x ratio of 1.0. (The average ratio of NO_2 to NO_x at the outlet test sites during the eleven cycles was 0.999 with a standard deviation of .040. The variations about the mean were due to a combination of instrumental, recorder and chart reading imprecision.)

9. The inlet flows into the sieve and the flows diverted for regeneration (regeneration flow) were read from copies of process instrument charts for the respective times. All times were converted to elapsed time with reference to the beginning of each cycle. These values appear in columns 15, 16 and 17 on the worksheet.

10. The data appearing in columns 15 through 19 for each of the eleven cycles was keypunched and read into a computer program which produced the outputs presented in this section, Tables A-1 through A-31. An example calculation for the first 4 minutes of test cycle 11 with an explantion of each parameter preceeds the output tables.

EXAMPLE CALCULATIONS

FOR

TABLE A-31

The first five columns of Table A-31 contain the reduced strip chart data that was read into the computer program. The columns are:

TIME INTO CYCLE - (TIC) - The elapsed time from the beginning of an adsorption cycle. Units: minutes.

INLET FLOW - (IF) - The flow rate of the tail gas stream into the adsorbing bed. Units: standard cubic feet per minute.

REGEN FLOW - (RF) - The flow rate of the cleaned tail gas stream which is diverted after leaving the adsorption bed for regenerations of the second bed. Units: standard cubic feet per minute.

INLET CONC - (IC) - The concentration of NO_x in the inlet stream to the adsorption bed. For test cycles 1 through 8 this represents the NO_x concentration at site HV-12, after the feed chiller and mist eliminator. For test cycles 9-11, this represents the NO_x concentrations at HV-23. Units: parts per million.

OUTLET CONC - (OC) - The concentration of the NO_x in the outlet stream after passing through the adsorption bed. For test cycles 1 through 11 this represents the NO_x concentrations at site HV-13.

The last seven columns are calculated instanteous mass flow rates and control efficiencies. The columns are:

MASS FLOW RATE IN - (MFRI) - The NO_x mass flow rate into the adsorption bed. This value is calculated as follows:

$$MFRI = IF \times IC \times C$$

where C is the conversion factor for converting ppm ft^3 at 15.556°C (60°F) and 760 milimeters of mercury pressure to grams of NO_x as NO_2 (M.W. = 46)

$$C = \frac{46 \text{ gm mole}^{-1}}{22.414 \ \ell \text{ mole}^{-1} \times \frac{288.716°K}{273.15°K}} \times 10^{-6} \text{ ppm}^{-1} \times 28.316 \ \ell \text{ ft}^{-3}$$

$$= 5.49815 \times 10^{-5} \text{ gm ppm}^{-1} \text{ ft}^{-3}$$

Example Calculation, Test 11

TIC (min)	MFRI (gm min^{-1})	IF (ft^3 min^{-1})	IC (ppm)	C (gm ppm^{-1} ft^{-3})
0	1010.010	5500	3340	5.49815×10^{-5}
3	1003.962	5500	3320	5.49815×10^{-5}
4	1016.058	5500	3360	5.49815×10^{-5}

MASS FLOW RATE ADS - (MFRA) - The instantaneous mass flow rate at which NO_x is absorbed by the molecular sieve bed. This value is calculated as follows:

$$MFRA = IF \times (IC-OC) \times C$$

Example Calculation, Test 11

TIC (min)	MFRA (gm min^{-1})	IF (ft^3 min^{-1})	IC (ppm)	OC (ppm)	C (gm ppm^{-1} ft^{-3})
0	952.554	5500	3340	190	5.49815×10^{-5}
3	976.746	5500	3320	90	5.49815×10^{-5}
4	991.261	5500	3360	82	5.49815×10^{-5}

MASS FLOW RATE REGEN - (MFRR) - The instantaneous mass flow rate of the NO_x diverted for the regeneration of the second bed. This value is calculated as follows:

$$MFRR = RF \times OC \times C$$

Example Calculation, Test 11

TIC (min)	MFRR (gm min^{-1})	RF (ft^3 min^{-1})	OC (ppm)	C (gm ppm^{-1} ft^{-3})
0	10.655	1020	190	5.49815×10^{-5}
3	5.047	1020	90	5.49815×10^{-5}
4	4.576	1015	82	5.49815×10^{-5}

MASS FLOW RATE EMIT - (MFRE) - The instantaneous mass flow rate of NO_x emitted to the atmosphere from the stack outlet. This value is calculated as follows:

$$MFRE = MFRI - MFRA - MFRR$$

Example Calculation, Test 11

TIC (min)	MFRE (gm min^{-1})	MFRI (gm min^{-1})	MFRA (gm min^{-1})	MFRR (gm min^{-1})
0	46.801	1010.010	952.554	10.655
3	22.169	1003.962	976.746	5.047
4	20.221	1016.058	991.261	4.576

% REDUC OF NO_x DUE TO ADS - (RDTA) - The percentage of the instantaneous NO_x removal efficiency of the PuraSiv N unit due to adsorption. This value is calculated as follows:

$$\% \ RDTA = (MFRA \div MFRI) \times 100$$

Example Calculation, Test 11

TIC (min)	% RDTA (%)	MFRA (gm min^{-1})	MFRI (gm min^{-1})
0	94.3113	952.554	1010.010
3	97.2891	976.746	1003.962
4	97.5594	991.261	1016.058

% REDUC OF NO_X DUE TO REGEN - (% RDTR) - The percentage of the instantaneous NO_x removal efficiency of the PuraSiv N unit due to regeneration. This value is calculated as follows:

$$\% \text{ RDTR} = (\text{FMRR} \div \text{MFRI}) \times 100$$

Example Calculation, Test 11

TIC (min)	% RDTR (%)	MFRR (gm min^{-1})	MFRI (gm min^{-1})
0	1.0549	10.655	1010.010
3	0.5027	5.047	1003.962
4	0.4504	4.576	1016.058

% REDUC OF NO_X - (%R) - The instantaneous NO_x removal efficiency of the PuraSiv N unit. This value is calculated as follows:

$$\% \text{ R} = \% \text{ RDTA} + \% \text{ RDTR}$$

Example Calculation, Test 11

TIC (min)	% R (%)	% RDTA (%)	% RDTR (%)
0	95.366	94.311	1.055
3	97.792	97.289	0.503
4	98.009	97.559	0.450

EXAMPLE CALCULATIONS

FOR

TABLE A-32

The first column contains the time interval of the cycle for which the calculations pertain. The next eight columns are calculated NO_x mass loadings and average control efficiencies for each interval. The last column lists the average ppm emitted during each interval. The columns are:

NO_X IN DURING INTERVAL - (NIDI) - The mass of NO_x which enters the inlet to the adsorption bed during the designated interval (a,b). This value is calculated as follows:

$$NIDI = ((MFRI(a) + MFRI(b)) \times (b-a)) \div 2$$

Example Calculation, Test 11

INT (a,b)	NIDI (gm)	MFRI(a) (gm min^{-1})	MFRI(b) (gm min^{-1})	(b-a) (min)
0,3	3020.958	1010.010	1003.962	3
3,4	1010.010	1003.962	1016.058	1

NO_X ABSORBED DURING INTERVAL - (NADI) - The mass of NO_x which is adsorbed by the adsorption bed during the designated interval (a,b). This value is calculated as follows:

$$NADI = ((MFRA(a) + MFRA(b)) \times (b-a) \div 2$$

Example Calculation, Test 11

INT (a,b)	NIDI (gm)	MFRI(a) (gm min^{-1})	MFRI(b) (gm min^{-1})	(b-a) (min)
0,3	2893.950	952.554	976.746	3
3,4	984.004	976.746	991.261	1

NO_X REGEN DURING INTERVAL - (NRDI) - The mass of NO_x which is diverted during the regeneration of the second bed during the designated interval (a,b). This value is calculated as follows:

$$NRDI = ((MFRR(a) + MFRR(b)) \times (b-a)) \div 2$$

Example Calculation, Test 11

INT (a,b)	NRDI (gm)	MFRR(a) (gm min^{-1})	MFRR(b) (gm min^{-1})	(b-a) (min)
0,3	23.553	10.655	5.047	3
3,4	4.811	5.047	4.576	1

NO_x EMITTED DURING INTERVAL - (NEDI) - The mass of NO_x emitted to the atmosphere from the stack outlet during the interval (a,b). This value is calculated as follows:

$$NEDI = NIDI - NADI - NRDI$$

Example Calculation, Test 11

INT (a,b)	NEDI (gm)	NIDI (gm)	NADI (gm)	NRDF (gm)
0,3	103.455	3020.958	2893.950	23.553
3,4	21.194	1010.010	984.004	4.812

PERCENT OF NO_x ADSORBED DURING INTERVAL - (% ADI) - The percentage of the NO_x removal efficiency due to adsorption during the interval (a,b). This value is calculated as follows:

$$\% ADI = (NADI \div NIDI) \times 100$$

Example Calculation, Test 11

INT (a,b)	% ADI (%)	NADI (gm)	NIDI (gm)
0,3	95.796	2893.950	3020.958
3,4	97.425	984.004	1010.010

PERCENT NO_X FOR REGEN DURING INTERVAL - (%RDI) - The precentage of the NO_x removal efficiency due to regeneration during the interval (a,b). This value is calculated as follows:

$$\% \text{ RDI} = (\text{NRDI} \div \text{NIDI}) \times 100$$

Example Calculation, Test 11

INT (a,b)	% RDI (%)	NRDI (gm)	NIDI (gm)
0,3	0.780	23.553	3020.958
3,4	0.476	4.812	1010.010

PERCENT REDUCTION OF NO_X DURING INTERVAL - (% RI) - The NO_x removal efficiency of the PuraSiv N unit during the interval (a,b). This value is calculated as follows:

$$\% \text{ RI} = \% \text{ NADI} + \% \text{ NFRDI}$$

Example Calculation, Test 11

INT (a,b)	% RI (%)	% NADI (%)	% NFRDI (%)
0,3	96.576	95.796	0.780
3,4	97.901	97.425	0.476

AVERAGE PPM OF NO_X EMIT DURING INTERVAL - (APPM) - The average concentrations of NO_x emitted to the atmospheric from the stack outlet during the interval (a,b). This value is calculated as follows:

$$\text{APPM} = (\text{OC(a)} + \text{OC(b)}) \div 2$$

Example Calculation, Test 11

INT (a,b)	APPM (ppm)	OC(a) (ppm)	OC(b) (ppm)
0,3	140	190	90
3,4	86	90	82

EXAMPLE CALCULATIONS

FOR

TABLE A-33

The first column contains the elapsed time from the beginning of the cycle. Columns 2 through 5 contains the cumulative mass loadings which occurred from the beginning of the cycle to the time indicated. Columns 6 through 8 contain the average NO_x reductions achieved over the indicated time period. Column 9 contains the average ppm of NO_x emitted from the beginning of the cycle to the indicated time. The columns are:

TOTAL NO_X IN - (TNI) - The total mass of NO_x which entered the adsorption bed from the beginning of the cycle to the indicated time (TIC). This value is calculated as follows:

$$TNI = \sum_{0}^{TIC} NIDI$$

Example Calculation, Test 11

TIC (min)	INT (min)	TNI (gm)	NIDI (gm)
3	(0,3)	3020.958	3020.958
4	(3,4)	4030.968	1010.010

TOTAL NO_X ADS - (TNA) - The total mass of NO_x adsorbed molecular sieve bed from the beginning of the cycle to the indicated time. This value is calculated as follows:

$$TNA = \sum_{0}^{TIC} NADI$$

Example Calculation, Test 11

TIC (min)	INT (min)	TNA (gm)	NADI (gm)
3	0,3	2893.950	2893.950
4	3,4	3877.954	984.004

TOTAL NO_X USED FOR REGEN - (TNR) - The total mass of NO_x diverted for the regeneraton of the second bed from the beginning of the cycle to the indicated time. This value is calculated as follows:

$$TNR = \sum_{0}^{TIC} NRDI$$

Example Calculation, Test 11

TIC (min)	INT (min)	TNR (gm)	NRDI (gm)
3	0,3	23.553	23.553
4	3,4	28.364	4.811

TOTAL NO_X EMITTED - (TNE) - The total mass of NO_x emitted to the atmosphere from the stack outlet from the beginning of the cycle to the indicated time. This value is calculated as follows:

$$TNE = \sum_{0}^{TIC} NEDI$$

Example Calculation, Test 11

TIC (min)	INT (min)	TNE (gm)	NEDI (gm)
3	0,3	103.455	103.455
4	3,4	124.649	21.199

% NO_X REDUC DUE TO ADS - (% NRDTA) - The percentage of the average NO_x removal efficiency due to adsorption from the beginning of the cycle to the indiciated time. This value is calculated as follows:

$$\% \ NRDTA = TNA \div TNI \times 100$$

Example Calculation, Test 11

TIC (min)	% NRDTA (%)	TNA (gm)	TNI (gm)
3	95.795	2893.950	3020.958
4	96.204	3877.954	4030.968

% NO_X REDUC DUE TO REGEN - (%NRDTR) - The percentage of the average NO_x removal efficiency due to regeneration from the beginning of the cycle to the indicated time. This value is calculated as follows:

$$\% \text{ NRDTR} = \text{TNUFR} \div \text{TNI} \times 100$$

Example Calculation, Text 11

TIC (min)	% NRDTR (%)	TNUFR (gm)	TNI (gm)
3	0.780	23.553	3020.958
4	0.703	28.364	4030.968

AVG % REDUC OF NO_X - (A % R) - The average NO_x removal efficiency of the PuraSiv N unit from the beginning of the cycle to the indicated time. This value is calculated as follows:

$$\text{A \% R} = \text{\% NRDTA} + \text{\% NRDTR}$$

Example Calculation, Test 11

TIC (min)	A % R (%)	% NRDTA (%)	% NRDTR (%)
3	96.575	95.795	0.780
4	96.907	96.204	0.703

AVG PPM OF NO_X EMIT DURING INTERVAL - (APPME) - The average concentration of NO_x emitted to the atmosphere from the stack outlet, from the beginning of the cycle to the indicated time. This value is calculated as follows:

$$\text{APPME} = (\Sigma(b-a) \times \text{APPM}) \div \text{TIC}$$

Example Calculation, Test 11

TIC (min)	APPME (ppm)	(a,b) (min)	(b-a) (min)	APPM (ppm)
3	140.0	0,3	3	140
4	126.5	3,4	1	86

TABLE A-1. SUMMARY OF CALCULATED NO_x MASS FLOW RATES AND CONTROL EFFICIENCIES FOR INSTANTANEOUS FLOW AND CONCENTRATION DATA FOR TEST -- 1

HERCULES INC., RUN 1, INLET HV-12, OUTLET HV-13, UNIT B, 1412-1800 3/5/75

TIME INTO CYCLE (MIN)	INLET FLOW (SCFM)	REGEN. FLOW (SCFM)	INLET CONC. (PPM)	OUTLET CONC. (PPM)	MASS FLOW RATE IN (G/MIN)	MASS FLOW RATE ADS. (G/MIN)	MASS FLOW RATE REGEN. (G/MIN)	MASS FLOW RATE EMIT. (G/MIN)	% REDUC. OF NOX DUE TO ADS.	% REDUC. OF NOX DUE TO REGEN.	% REDUC. OF NOX
0.0	5625	1025	2090	166	646.4	595.0	9.36	41.98	92.06	1.45	93.50
3.0	5975	1025	2080	92	683.3	653.1	5.18	25.04	95.58	0.76	96.34
8.0	5975	1020	2080	80	683.3	657.0	4.49	21.79	95.15	0.66	96.81
18.0	5975	1020	2020	109	663.6	627.8	6.11	29.70	94.60	0.92	95.53
23.0	5975	1020	2020	84	663.6	636.0	4.71	22.88	95.84	0.71	96.55
33.0	5975	1025	1980	65	650.5	629.1	3.66	17.69	95.72	0.56	97.28
38.0	5950	1025	2070	70	677.2	654.3	3.94	18.95	96.62	0.58	97.20
42.0	5950	1025	2200	64	719.7	698.8	3.61	17.33	97.09	0.50	97.59
49.0	5950	1025	2670	75	873.5	848.9	4.23	20.31	97.19	0.48	97.67
56.0	5975	1025	2800	79	919.8	893.9	4.45	21.50	97.18	0.48	97.66
64.0	5975	1025	2550	81	837.7	811.1	4.56	22.04	96.82	0.54	97.37
68.0	5975	1025	2600	81	854.1	827.5	4.56	22.04	96.88	0.53	97.42
78.0	5700	1025	2660	84	833.6	807.3	4.73	21.59	95.84	0.57	97.41
83.0	5675	1025	2660	86	830.0	803.1	4.85	21.99	96.77	0.58	97.35
93.0	5675	1025	2650	89	826.9	799.1	5.02	22.75	95.64	0.61	97.25
98.0	5675	1025	2650	91	826.9	798.5	5.13	23.27	96.57	0.62	97.19
103.0	5675	1025	2680	95	836.2	806.5	5.35	24.29	95.46	0.64	97.10
113.0	5675	1025	2690	99	839.3	808.4	5.58	25.31	96.32	0.66	96.98
123.0	5675	1025	2660	95	830.0	800.3	5.35	24.29	96.43	0.65	97.07
133.0	5650	1025	2600	114	807.7	772.3	6.42	28.99	95.62	0.80	96.41
143.0	5675	1025	2770	118	864.3	827.5	6.65	30.17	95.74	0.77	96.51
153.0	5650	1025	2930	130	910.2	869.8	7.33	33.06	95.56	0.80	96.37
158.0	5650	1025	2900	135	900.9	858.9	7.61	34.33	95.34	0.84	95.19
168.0	5625	1025	2750	141	850.5	806.9	7.95	35.66	94.87	0.93	95.81
173.0	5625	1025	2700	142	835.0	791.1	8.00	35.91	94.74	0.96	95.70
183.0	5750	1025	2650	151	837.8	790.0	8.51	39.23	94.30	1.02	95.32
188.0	5650	1025	2650	155	823.2	775.1	8.74	39.41	94.15	1.06	95.21
198.0	5675	1025	2610	161	814.4	764.1	9.07	41.16	93.83	1.11	94.95
203.0	5700	1025	2650	170	830.5	777.2	9.58	43.70	93.58	1.15	94.74
213.0	5700	1025	2680	174	839.9	785.4	9.81	44.72	93.51	1.17	94.67
218.0	5675	1025	2660	179	830.0	774.1	10.09	45.76	93.27	1.22	94.49
228.0	5650	1025	2640	185	820.1	762.6	10.43	47.04	92.99	1.27	94.26

TABLE A-2. SUMMARY OF NO_x MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF NO_x EMITTED FOR INTERVALS DURING TEST -- 1

HERCULES INC., RUN 1, INLET HV-12, OUTLET HV-13, UNIT 8, 1412-1800 3/5/75

INTERVAL OF CYCLE (MIN)	NOX IN DURING INTERVAL (GRAMS)	NOX ADSORBED DURING INTERVAL (GRAMS)	NOX REGEN. DURING INTERVAL (GRAMS)	NOX EMITTED DURING INTERVAL (GRAMS)	PERCENT OF NOX ADSORBED DURING INTERVAL	PERCENT NOX FOR REGEN. DURING INTERVAL	PERCENT REDUC. OF NOX DURING INTERVAL	AVERAGE PPM OF NOX EMIT. DURING INTERVAL
0.0- 3.0	1994.5	1872.2	21.81	100.53	93.87	1.09	94.96	128
3.0- 8.0	3416.5	3275.3	24.18	117.08	95.87	0.71	96.57	86
8.0- 18.0	6734.5	6424.1	53.00	257.45	95.39	0.79	96.18	95
18.0- 23.0	3318.0	3159.5	27.06	131.45	95.22	0.82	96.04	97
23.0- 33.0	6570.3	6325.5	41.87	202.87	96.27	0.64	96.91	75
33.0- 38.0	3319.1	3208.5	19.02	91.61	96.67	0.57	97.24	67
38.0- 42.0	2793.8	2706.1	15.10	72.57	96.86	0.54	97.40	67
42.0- 49.0	5576.1	5416.9	27.42	131.74	97.15	0.49	97.64	70
49.0- 56.0	6276.6	6099.9	30.38	146.33	97.18	0.48	97.67	77
56.0- 64.0	7030.2	6820.0	36.07	174.18	97.01	0.51	97.52	80
64.0- 68.0	3383.7	3277.3	18.26	88.18	96.85	0.54	97.39	81
68.0- 78.0	8438.8	8174.2	46.49	218.18	96.86	0.55	97.41	82
78.0- 83.0	4159.0	4026.1	23.95	108.95	96.80	0.58	97.38	85
83.0- 93.0	8284.1	8011.1	49.31	223.71	96.70	0.60	97.30	87
93.0- 98.0	4134.3	3993.9	25.36	115.05	96.60	0.61	97.22	90
98.0-108.0	8315.3	8025.1	52.41	237.77	96.51	0.63	97.14	93
108.0-113.0	4188.9	4037.5	27.33	124.00	96.39	0.65	97.04	97
113.0-123.0	8346.5	8043.9	54.67	247.99	96.37	0.65	97.03	97
123.0-138.0	12282.4	11794.5	88.34	399.58	96.03	0.72	96.75	104
138.0-143.0	4179.9	3999.3	32.69	147.89	95.68	0.78	96.46	116
143.0-153.0	8872.4	8486.4	69.88	316.13	95.65	0.79	96.44	124
153.0-158.0	4527.7	4321.8	37.34	168.47	95.45	0.82	96.28	133
158.0-168.0	8756.8	8329.1	77.77	349.95	95.12	0.89	96.00	138
168.0-173.0	4213.8	3995.0	39.87	178.94	94.81	0.95	95.75	141
173.0-183.0	8364.1	7905.8	82.56	375.71	94.52	0.99	95.51	147
183.0-188.0	4152.5	3912.8	43.11	196.61	94.23	1.04	95.27	153
188.0-198.0	8187.9	7696.0	89.04	402.88	93.99	1.09	95.08	158
198.0-205.0	5757.0	5394.7	65.29	297.00	93.71	1.13	94.84	166
205.0-213.0	6681.6	6250.3	77.55	353.68	93.55	1.16	94.71	172
213.0-218.0	4174.7	3898.7	49.73	226.22	93.39	1.19	94.58	176
218.0-228.0	8250.4	7683.8	102.57	464.04	93.13	1.24	94.38	182

TABLE A-3. CUMULATIVE NO_x MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF NO_x EMITTED DURING TEST -- 1

HERCULES INC., RUN 1, INLET HV-12, OUTLET HV-13, UNIT 8, 1412-1800 3/5/75

TIME INTO CYCLE (MIN)	TOTAL NOX IN (GRAMS)	TOTAL NOX ADS. (GRAMS)	NOX USED FOR REGEN. (GRAMS)	TOTAL NOX EMIT. (GRAMS)	% NOX REDUC. DUE TO ADS.	% NOX REDUC. DUE TO REGEN.	AVG. % REDUC. OF NOX	AVG. PPM OF NOX EMIT.
0								
3.0	1994.5	1872.2	21.8	100.5	93.87	1.09	94.96	128
8.0	5411.1	5147.5	46.0	217.6	95.13	0.85	95.98	101
18.0	12145.6	11571.6	99.0	475.1	95.27	0.81	96.09	97
23.0	15463.6	14731.1	126.0	606.5	95.26	0.82	96.08	97
33.0	22033.9	21056.6	167.9	809.4	95.56	0.76	96.33	90
38.0	25353.0	24265.1	186.9	901.0	95.71	0.74	96.45	87
42.0	28146.8	26971.2	202.0	973.6	95.82	0.72	96.54	85
49.0	33722.9	32388.1	229.5	1105.3	96.04	0.68	96.72	83
56.0	39999.4	38487.9	259.8	1251.6	96.22	0.65	96.87	82
64.0	47029.6	45307.9	295.9	1425.8	96.34	0.63	96.97	82
68.0	50413.3	48585.2	314.2	1514.0	96.37	0.62	97.00	82
73.0	58852.1	56759.3	360.7	1732.2	96.44	0.61	97.06	82
83.0	63011.1	60785.4	384.6	1841.1	96.47	0.61	97.08	82
93.0	71295.3	68796.5	433.9	2064.8	96.50	0.61	97.10	83
98.0	75429.5	72790.4	459.3	2179.9	96.50	0.61	97.11	83
108.0	83744.9	80815.5	511.7	2417.6	96.50	0.61	97.11	84
113.0	87933.7	84853.1	539.0	2541.6	96.50	0.61	97.11	85
123.0	96283.3	92896.9	593.7	2789.6	96.49	0.62	97.10	86
138.0	108562.6	104691.4	682.0	3189.2	96.43	0.63	97.06	88
143.0	112742.6	108690.7	714.7	3337.1	96.41	0.63	97.04	88
153.0	121615.0	117177.2	784.6	3653.2	96.35	0.65	97.00	91
158.0	126142.6	121499.0	821.9	3821.7	96.32	0.65	96.97	92
168.0	134899.5	129828.1	899.7	4171.7	96.24	0.67	96.91	95
173.0	139113.3	133823.1	939.6	4350.6	96.20	0.68	96.87	96
183.0	147477.3	141728.9	1022.1	4726.3	96.10	0.69	96.80	99
188.0	151629.8	145641.7	1065.2	4922.9	96.05	0.70	96.75	100
198.0	159817.7	153337.6	1154.3	5325.8	95.95	0.72	96.67	103
208.0	165574.7	158732.4	1219.6	5622.8	95.87	0.74	96.60	105
213.0	172256.3	164982.7	1297.1	5976.5	95.78	0.75	96.53	108
218.0	176431.0	168881.4	1346.9	6202.7	95.72	0.76	96.48	109
228.0	184681.4	176565.2	1449.4	6666.7	95.61	0.78	96.39	112

TABLE A-4. SUMMARY OF CALCULATED NO_X MASS FLOW RATES AND CONTROL EFFICIENCIES FOR INSTANTANEOUS FLOW AND CONCENTRATION DATA FOR TEST -- 2

HERCULES INC., RUN 2, INLET HV-12, OUTLET HV-13, UNIT B, 1010-1408 3/6/75

TIME INTO CYCLE (MIN)	INLET FLOW (SCFM)	REGEN. FLOW (SCFM)	INLET CONC. (PPM)	OUTLET CONC. (PPM)	MASS FLOW RATE IN (G/MIN)	MASS FLOW RATE ADS. (G/MIN)	MASS FLOW RATE REGEN. (G/MIN)	MASS FLOW RATE EMIT. (G/MIN)	% REDUC. OF NOX DUE TO ADS.	% REDUC. OF NOX DUE TO REGEN.	% REDUC. OF NOX
0.0	5750	1050	2470	141	730.9	736.3	8.14	36.44	94.29	1.04	95.33
2.0	5575	1055	2430	41	744.8	732.3	2.38	10.19	98.31	0.32	98.63
5.0	5575	1055	2410	62	738.7	719.7	3.60	15.41	97.43	0.49	97.91
10.0	5575	1055	2630	90	806.2	778.6	5.22	22.37	96.58	0.65	97.23
12.0	5575	1055	2670	85	818.4	792.4	4.93	21.12	95.82	0.60	97.42
20.0	5675	1055	2680	74	836.2	813.1	4.29	18.80	97.24	0.51	97.75
30.0	5725	1055	2630	50	827.8	812.1	2.90	12.84	98.10	0.35	98.45
35.0	5725	1055	2680	49	843.6	828.2	2.84	12.58	98.17	0.34	98.51
40.0	5725	1055	2710	49	853.0	837.6	2.84	12.58	98.19	0.33	98.53
45.0	5725	1055	2650	50	834.1	818.4	2.90	12.84	98.11	0.35	98.46
50.0	5725	1055	2770	52	871.9	855.5	3.02	13.35	98.12	0.35	98.47
55.0	5725	1050	2820	54	887.6	870.7	3.12	13.88	98.09	0.35	98.44
58.0	5725	1050	2870	56	903.4	885.8	3.23	14.39	98.05	0.36	98.41
62.0	5725	1050	3040	61	957.8	938.6	3.52	15.68	98.00	0.37	98.36
65.0	5725	1050	3100	61	975.8	956.6	3.52	15.68	98.03	0.36	98.39
70.0	5725	1050	3180	71	1001.0	978.6	4.10	18.25	97.77	0.41	98.18
76.0	5725	1050	3300	82	1038.7	1012.9	4.73	21.08	97.52	0.46	97.97
80.0	5725	1050	3260	85	1026.1	999.4	4.91	21.85	97.39	0.48	97.87
85.0	5725	1045	3310	90	1041.9	1013.6	5.17	23.16	97.28	0.50	97.78
87.0	5725	1050	3440	96	1082.8	1052.6	5.54	24.68	97.21	0.51	97.72
95.0	5725	1050	3390	104	1067.1	1034.3	6.00	26.73	96.93	0.56	97.49
110.0	5725	1040	3220	125	1013.6	974.2	7.15	32.20	95.12	0.71	96.82
115.0	5725	1040	3150	130	991.5	950.6	7.43	33.49	95.87	0.75	96.62
120.0	5725	1040	3100	135	975.8	933.3	7.72	34.77	95.65	0.79	96.44
125.0	5725	1035	3100	139	975.8	932.0	7.91	35.84	95.52	0.81	96.33
130.0	5725	1025	3120	145	982.1	936.4	8.17	37.47	95.35	0.83	96.18
135.0	5725	1025	3280	154	1032.4	984.0	8.68	39.80	95.30	0.84	96.15
140.0	5725	1030	3350	171	1054.5	1000.6	9.68	44.14	94.90	0.92	95.81
150.0	5700	1025	3300	188	1034.2	975.3	10.59	48.32	94.30	1.02	95.33
152.0	5700	1025	3300	185	1034.2	976.2	10.43	47.55	94.39	1.01	95.40
155.0	5725	1025	3310	195	1041.9	980.5	10.99	50.39	94.11	1.05	95.16
160.0	5725	1025	3360	204	1057.6	993.4	11.50	52.72	93.93	1.09	95.02
165.0	5725	1025	3380	215	1063.9	996.2	12.12	55.56	93.64	1.14	94.78
170.0	5700	1025	3300	232	1034.2	961.5	13.07	59.63	92.97	1.26	94.23
175.0	5675	1040	3360	238	1048.4	974.1	13.61	60.65	92.92	1.30	94.21
180.0	5650	1045	3480	253	1081.0	1002.5	14.54	64.06	92.73	1.34	94.07
190.0	5625	1045	3320	268	1026.8	943.9	15.40	67.49	91.93	1.50	93.43
195.0	5625	1050	3000	275	927.8	842.8	15.88	69.17	90.83	1.71	92.54
200.0	5650	1050	2990	274	928.8	843.7	15.82	69.30	90.84	1.70	92.54
205.0	5650	1055	2980	272	925.7	841.2	15.78	68.72	90.87	1.70	92.58
210.0	5625	1055	2970	274	918.5	833.8	15.89	68.85	90.77	1.73	92.50
215.0	5625	1055	2960	276	915.4	830.1	16.01	69.35	90.68	1.75	92.42
220.0	5625	1055	3030	279	937.1	850.8	16.18	70.10	90.79	1.73	92.52
230.0	5625	1055	3120	288	964.9	875.9	16.71	72.36	90.77	1.73	92.50
235.0	5625	1055	2970	290	918.5	828.8	16.82	72.87	90.24	1.83	92.07
238.0	5625	1055	2910	291	900.0	810.0	16.88	73.12	90.00	1.88	91.88

TABLE A-5. SUMMARY OF NO_x MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF NO_x EMITTED FOR INTERVALS DURING TEST -- 2

HERCULES INC., RUN 2, INLET HV-12, OUTLET HV-13, UNIT 8, 1010-1408 3/6/75

INTERVAL OF CYCLE (MIN)	NOX IN DURING INTERVAL (GRAMS)	NOX ADSORBED DURING INTERVAL (GRAMS)	NOX REGEN. DURING INTERVAL (GRAMS)	NOX EMITTED DURING INTERVAL (GRAMS)	PERCENT OF NOX ADSORBED DURING INTERVAL	PERCENT NOX FOR REGEN. DURING INTERVAL	PERCENT REDUC. OF NOX DURING INTERVAL	AVERAGE PPM OF NOX EMIT. DURING INTERVAL
0.0- 2.0	1525.7	1468.6	10.52	46.63	96.25	0.69	96.94	92
2.0- 5.0	2225.3	2178.0	8.96	38.40	97.87	0.40	98.27	51
5.0- 10.0	3862.2	3745.7	22.04	94.44	96.98	0.57	97.55	76
10.0- 12.0	1624.6	1570.9	10.15	43.49	96.70	0.62	97.32	88
12.0- 20.0	6613.5	6421.9	36.89	159.68	97.03	0.56	97.59	79
20.0- 30.0	8320.3	8126.1	35.96	158.18	97.67	0.43	98.10	62
30.0- 35.0	4178.6	4100.6	14.36	63.55	98.14	0.34	98.48	49
35.0- 40.0	4241.5	4164.4	14.21	62.91	98.18	0.34	98.52	49
40.0- 45.0	4217.9	4140.0	14.36	63.55	98.15	0.34	98.49	49
45.0- 50.0	4265.1	4184.9	14.79	65.47	98.12	0.35	98.46	51
50.0- 55.0	4398.9	4315.5	15.33	68.08	98.10	0.35	98.45	53
55.0- 58.0	2686.6	2634.6	9.53	42.41	98.07	0.35	98.42	55
58.0- 62.0	3722.5	3648.8	13.51	60.15	98.02	0.36	98.38	59
62.0- 65.0	2900.4	2842.8	10.56	47.04	98.01	0.36	98.38	61
65.0- 70.0	4941.9	4838.0	19.05	84.82	97.90	0.39	98.28	66
70.0- 78.0	8158.8	7966.2	35.33	157.31	97.64	0.43	98.07	77
78.0- 80.0	2064.9	2012.3	9.64	42.93	97.45	0.47	97.92	83
80.0- 85.0	5170.1	5032.4	25.20	112.52	97.34	0.49	97.82	88
85.0- 89.0	4249.4	4132.3	21.43	95.67	97.24	0.50	97.75	93
89.0- 95.0	6449.6	6260.8	34.64	154.22	97.07	0.54	97.61	100
95.0-110.0	15604.7	15064.0	98.64	441.98	96.54	0.63	97.17	115
110.0-115.0	5012.7	4812.0	36.45	164.21	96.00	0.73	96.72	128
115.0-120.0	4919.3	4709.7	37.88	170.65	95.76	0.77	96.53	133
120.0-125.0	4878.9	4663.3	39.07	176.54	95.58	0.80	96.38	137
125.0-130.0	4894.7	4671.2	40.20	183.28	95.43	0.82	96.26	142
130.0-135.0	5035.3	4801.0	42.13	193.16	95.33	0.84	96.16	150
135.0-140.0	5217.3	4961.5	45.91	209.84	95.13	0.88	95.98	162
140.0-150.0	10443.4	9879.7	101.39	462.32	94.60	0.97	95.57	179
150.0-152.0	2068.4	1951.5	21.02	95.88	94.35	1.02	95.36	187
152.0-155.0	3114.1	2935.1	32.12	146.91	94.25	1.03	95.28	190
155.0-160.0	5248.8	4934.8	56.22	257.77	94.02	1.07	95.09	199
160.0-165.0	5303.9	4974.1	59.03	270.69	93.78	1.11	94.90	210
165.0-170.0	5245.3	4894.3	62.98	287.98	93.31	1.20	94.51	223
170.0-176.0	6247.3	5806.9	80.05	360.85	92.94	1.28	94.22	235
175.0-185.0	9592.4	8894.6	126.65	561.19	92.82	1.32	94.14	245
185.0-190.0	5259.6	4865.9	74.84	328.86	92.34	1.42	93.76	260
190.0-198.0	7818.4	7146.6	125.10	546.64	91.41	1.60	93.01	271
198.0-200.0	1856.6	1686.5	31.69	138.47	90.83	1.71	92.54	274
200.0-205.0	4636.4	4212.3	78.99	345.04	90.85	1.70	92.56	273
205.0-210.0	4610.6	4187.6	79.18	343.91	90.82	1.72	92.54	273
210.0-215.0	4584.9	4159.7	79.76	345.49	90.73	1.74	92.46	275
215.0-220.0	4631.3	4202.2	80.48	348.63	90.73	1.74	92.47	278
220.0-230.0	9510.1	8633.3	164.45	712.34	90.78	1.73	92.51	283
230.0-235.0	4708.6	4261.7	83.82	363.08	90.51	1.78	92.29	289
235.0-238.0	2727.8	2458.2	50.55	218.98	90.12	1.85	91.97	290

TABLE A-6. CUMULATIVE NO_X MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF NO_X EMITTED DURING TEST -- 2

HERCULES INC., RUN 2, INLET HV-12, OUTLET HV-13, UNIT 8, 1010-1408 3/6/75

TIME INTO CYCLE (MIN)	TOTAL NOX IN (GRAMS)	TOTAL NOX ADS. (GRAMS)	NOX USED FOR REGEN. (GRAMS)	TOTAL NOX EMIT. (GRAMS)	% NOX REDUC. DUE TO ADS.	% NOX REDUC. DUE TO REGEN.	AVG. % REDUC. OF NOX	AVG. PPM OF NOX EMIT.
0								
2.0	1525.7	1468.6	10.5	46.6	96.25	0.69	96.94	92
5.0	3751.1	3646.6	19.5	85.0	97.21	0.52	97.73	68
10.0	7613.2	7392.3	41.5	179.5	97.10	0.55	97.64	72
12.0	9237.8	8963.2	51.7	222.9	97.03	0.56	97.59	75
20.0	15856.3	15385.1	88.6	382.6	97.03	0.56	97.59	76
30.0	24176.6	23511.3	124.5	540.8	97.25	0.52	97.76	72
35.0	28355.1	27611.9	138.9	604.4	97.38	0.49	97.87	68
40.0	32596.7	31776.3	153.1	667.3	97.48	0.47	97.95	66
45.0	36814.6	35916.3	167.5	730.8	97.56	0.45	98.01	64
50.0	41079.7	40101.1	182.2	796.3	97.62	0.44	98.06	63
55.0	45478.6	44416.6	197.6	864.4	97.66	0.43	98.10	62
58.0	48165.1	47051.2	207.1	906.8	97.69	0.43	98.12	61
62.0	51887.6	50700.0	220.6	966.9	97.71	0.43	98.14	61
65.0	54788.0	53542.9	231.2	1014.0	97.73	0.42	98.15	61
70.0	59729.9	58380.9	250.2	1098.8	97.74	0.42	98.16	62
78.0	67888.7	66347.0	285.6	1256.1	97.73	0.42	98.15	63
80.0	69953.6	68359.4	295.2	1299.0	97.72	0.42	98.14	64
85.0	75123.6	73391.7	320.4	1411.5	97.69	0.43	98.12	65
88.0	79373.0	77524.0	341.8	1507.2	97.67	0.43	98.10	66
95.0	85622.6	83784.8	376.5	1661.4	97.63	0.44	98.06	68
110.0	101427.3	98846.8	475.1	2103.4	97.46	0.47	97.93	75
115.0	106440.0	103660.8	511.5	2267.6	97.39	0.48	97.87	77
120.0	111358.3	108370.6	549.4	2438.3	97.32	0.49	97.81	79
125.0	116237.2	113033.9	588.5	2614.8	97.24	0.51	97.75	82
130.0	121131.8	117705.0	628.7	2798.1	97.17	0.52	97.69	84
135.0	126163.1	122506.0	670.8	2991.3	97.10	0.53	97.63	87
140.0	131385.4	127467.6	716.7	3201.1	97.02	0.55	97.56	89
150.0	141628.8	137347.2	818.1	3663.4	96.84	0.58	97.42	95
152.0	143697.2	139296.7	839.2	3759.3	96.80	0.58	97.39	97
155.0	147011.3	142233.8	871.3	3906.2	96.75	0.59	97.34	98
160.0	152260.1	147168.6	927.5	4164.0	96.66	0.61	97.27	102
165.0	157564.3	152142.8	986.5	4434.7	96.56	0.63	97.19	105
170.0	162809.3	157037.1	1049.5	4722.6	96.45	0.64	97.10	108
175.0	168057.0	162344.0	1129.6	5083.5	96.32	0.67	96.99	113
180.0	178639.5	171738.6	1256.2	5644.7	96.14	0.70	96.84	119
190.0	183909.0	176604.4	1331.0	5973.6	96.03	0.72	96.75	123
195.0	191727.4	183751.1	1456.1	6520.2	95.84	0.76	96.60	129
200.0	193584.0	185437.5	1487.8	6658.7	95.79	0.77	96.56	130
205.0	199220.4	189649.9	1566.8	7003.7	95.68	0.79	96.47	134
210.0	202331.1	193837.4	1646.0	7347.6	95.57	0.81	96.38	137
215.0	207416.0	197997.1	1725.8	7693.1	95.46	0.83	96.29	140
220.0	212047.3	202199.3	1806.2	8041.7	95.36	0.85	96.21	143
230.0	221557.4	210832.6	1970.7	8754.1	95.16	0.89	96.05	149
235.0	226266.0	215094.4	2054.5	9117.2	95.06	0.91	95.97	152
238.0	228993.8	217552.6	2105.1	9336.1	95.00	0.92	95.92	154

TABLE A-7. SUMMARY OF CALCULATED NO_X MASS FLOW RATES AND CONTROL EFFICIENCIES FOR INSTANTANEOUS FLOW AND CONCENTRATION DATA FOR TEST -- 3

HERCULES INC., RUN 3, INLET HV-12, OUTLET HV-13, UNIT A 1408-1812 3/6/75

TIME INTO CYCLE (MIN)	INLET FLOW (SCFM)	REGEN. FLOW (SCFM)	INLET CONC. (PPM)	OUTLET CONC. (PPM)	MASS FLOW RATE IN (G/MIN)	MASS FLOW RATE ADS. (G/MIN)	MASS FLOW RATE REGEN. (G/MIN)	MASS FLOW RATE EMIT. (G/MIN)	% REDUC. OF NOX DUE TO ADS.	% REDUC. OF NOX DUE TO REGEN.	% REDUC. OF NOX
0.0	5625	1055	2910	291	900.0	810.0	16.88	73.12	90.00	1.88	91.88
6.0	5875	1045	2800	168	904.4	850.2	9.65	44.61	94.00	1.07	95.07
7.0	5875	1045	2910	161	940.0	888.0	9.25	42.76	94.47	0.98	95.45
12.0	5875	1040	2800	186	904.4	844.4	10.64	49.45	93.36	1.18	94.53
22.0	5850	1040	2820	126	907.0	866.5	7.20	33.32	95.53	0.79	96.33
27.0	5850	1040	2840	160	913.5	862.0	9.15	42.31	94.37	1.00	95.37
37.0	5850	1040	2820	89	907.0	878.4	5.09	23.54	96.84	0.56	97.41
42.0	5850	1040	2870	86	923.1	895.4	4.92	22.74	97.00	0.53	97.54
47.0	5850	1040	2900	82	932.8	906.4	4.69	21.69	97.17	0.50	97.68
52.0	5850	1040	2920	82	939.2	912.8	4.69	21.69	97.19	0.50	97.69
57.0	5850	1035	3060	84	984.2	957.2	4.78	22.24	97.25	0.49	97.74
67.0	5850	1035	3350	90	1077.5	1048.6	5.12	23.83	97.31	0.48	97.79
72.0	5850	1035	3480	92	1119.3	1089.7	5.24	24.36	97.36	0.47	97.82
82.0	5825	1035	3520	104	1127.3	1094.0	5.92	27.39	97.05	0.52	97.57
87.0	5850	1035	3420	108	1100.0	1065.3	6.15	28.59	96.84	0.56	97.40
97.0	5850	1035	3350	114	1077.5	1040.8	6.49	30.18	96.60	0.60	97.20
102.0	5875	1035	3320	116	1072.4	1034.9	6.60	30.87	96.51	0.62	97.12
112.0	5850	1035	3450	122	1109.7	1070.4	6.94	32.30	96.46	0.63	97.09
117.0	5875	1035	3360	129	1085.3	1043.7	7.34	34.33	95.16	0.68	96.84
123.0	5875	1035	3340	139	1078.9	1034.0	7.91	36.99	95.84	0.73	96.57
132.0	5875	1035	3280	142	1059.5	1013.6	8.08	37.79	95.67	0.76	96.43
144.0	5850	1035	3190	155	1026.0	976.2	8.82	41.03	95.14	0.86	95.00
147.0	5850	1035	3160	156	1016.4	966.2	8.88	41.30	95.06	0.87	95.94
157.0	5825	1020	3100	164	992.8	940.3	9.20	43.33	94.71	0.93	95.64
162.0	5825	1020	3080	170	986.4	932.0	9.53	44.91	94.48	0.97	95.45
172.0	5825	1020	3080	174	986.4	930.7	9.76	45.97	94.35	0.99	95.34
177.0	5825	1015	3040	178	973.6	916.6	9.93	47.07	94.14	1.02	95.17
182.0	5125	1050	3020	172	851.0	802.5	9.93	38.54	94.30	1.17	95.47
187.0	3425	1050	2420	168	455.7	424.1	9.70	21.94	93.06	2.13	95.19
192.0	3425	930	1970	162	371.0	340.5	8.28	22.22	91.78	2.23	94.01
197.0	3425	930	1060	164	199.6	168.7	8.39	22.50	84.53	4.20	88.73
202.0	3500	930	2000	148	384.9	356.4	7.57	20.91	92.60	1.97	94.57
205.0	2700	930	1510	308	224.2	178.4	15.75	29.97	79.60	7.03	86.63
207.0	2700	1125	1380	274	204.9	164.2	16.95	23.73	80.14	8.27	88.42
209.0	2700	1125	1100	156	163.3	140.1	9.65	13.51	85.82	5.91	91.73
212.0	4100	1050	750	148	169.1	135.7	8.54	24.82	80.27	5.05	85.32
217.0	5750	1020	1200	131	379.4	338.0	7.35	34.07	89.08	1.94	91.02
222.0	5125	1040	1560	138	439.6	400.7	7.89	30.99	91.15	1.80	92.95
232.0	5550	1030	2250	130	686.6	646.9	7.36	32.31	94.22	1.07	95.29
244.0	5450	1030	2580	150	773.1	728.1	8.49	36.45	94.19	1.10	95.28

TABLE A-8. SUMMARY OF NO_X MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF NO_X EMITTED FOR INTERVALS DURING TEST -- 3

HERCULES INC., RUN 3, INLET HV-12, OUTLET HV-13, UNIT A 1408-1812 3/6/75

INTERVAL OF CYCLE (MIN)	NOX IN DURING INTERVAL (GRAMS)	NOX ADSORBED DURING INTERVAL (GRAMS)	NOX REGEN. DURING INTERVAL (GRAMS)	NOX EMITTED DURING INTERVAL (GRAMS)	PERCENT OF NOX ADSORBED DURING INTERVAL	PERCENT NOX FOR REGEN. DURING INTERVAL	PERCENT REDUC. OF NOX DURING INTERVAL	AVERAGE PPM OF NOX EMIT. DURING INTERVAL
0.0- 6.0	5413.3	4980.5	79.60	353.20	92.00	1.47	93.48	228
6.0- 7.0	922.2	869.1	9.45	43.68	94.24	1.02	95.26	165
7.0- 12.0	4611.1	4330.8	49.71	230.50	93.92	1.08	95.00	174
12.0- 22.0	9057.4	8554.3	89.20	413.84	94.45	0.98	95.43	156
22.0- 27.0	4551.2	4321.3	40.88	189.09	94.95	0.90	95.85	143
27.0- 37.0	9102.5	8702.0	71.19	329.25	95.60	0.78	96.38	124
37.0- 42.0	4575.3	4434.6	25.02	115.70	96.92	0.55	97.47	87
42.0- 47.0	4639.7	4504.6	24.02	111.07	97.09	0.52	97.61	84
47.0- 52.0	4679.9	4548.0	23.44	108.43	97.18	0.50	97.68	82
52.0- 57.0	4838.5	4675.1	23.67	109.81	97.22	0.49	97.72	83
57.0- 67.0	10309.6	10028.8	49.51	230.32	97.29	0.48	97.77	87
67.0- 72.0	5492.0	5345.7	25.89	120.45	97.34	0.47	97.81	91
72.0- 82.0	11233.3	10918.8	55.77	258.73	97.23	0.50	97.70	98
82.0- 87.0	5568.4	5398.3	30.16	139.95	96.95	0.54	97.49	106
87.0- 97.0	10887.6	10530.5	63.17	293.86	96.72	0.58	97.30	111
97.0-102.0	5374.9	5189.4	32.72	152.62	96.55	0.61	97.16	115
102.0-112.0	10910.4	10526.8	67.72	315.83	96.48	0.62	97.11	119
112.0-117.0	5487.5	5285.2	35.71	166.57	96.31	0.65	96.96	126
117.0-128.0	11903.1	11427.0	83.88	392.25	96.00	0.70	96.70	134
128.0-132.0	4276.7	4095.2	31.98	149.55	95.76	0.75	96.50	141
132.0-144.0	12513.2	11938.8	101.41	472.93	95.41	0.81	96.22	148
144.0-147.0	3063.6	2913.6	26.55	123.50	95.10	0.87	95.97	155
147.0-157.0	10046.1	9532.6	90.37	423.13	94.89	0.90	95.79	163
157.0-162.0	4948.1	4680.7	46.83	220.60	94.60	0.95	95.54	167
162.0-172.0	9864.2	9313.4	96.46	454.40	94.42	0.98	95.39	172
172.0-177.0	4903.1	4618.3	49.23	232.61	94.25	1.00	95.25	176
177.0-182.0	4561.5	4297.8	49.66	214.03	94.22	1.09	95.31	175
182.0-187.0	3266.7	3066.5	49.07	151.19	93.87	1.50	95.37	171
187.0-192.0	2065.7	1911.4	44.96	110.40	92.48	2.18	94.66	165
192.0-197.0	1426.5	1273.0	41.67	111.80	89.24	2.92	92.16	163
197.0-202.0	1461.2	1312.8	39.88	108.53	89.84	2.73	92.57	156
202.0-206.0	1218.1	1069.7	[illegible].63	101.77	87.82	3.83	91.64	213
206.0-207.0	214.5	171.3	16.35	26.85	79.86	7.62	87.48	292
207.0-209.0	369.2	304.3	26.60	37.24	82.66	7.22	89.89	215
209.0-212.0	498.5	413.8	27.29	57.49	82.99	5.47	88.47	151
212.0-217.0	1371.1	1184.2	39.73	147.22	86.37	2.90	89.26	138
217.0-222.0	2047.4	1846.6	38.09	162.66	90.19	1.86	92.06	134
222.0-232.0	5630.9	5238.0	76.26	316.51	93.02	1.35	94.38	134
232.0-244.0	8758.1	8250.4	95.14	412.56	94.20	1.09	95.29	140

TABLE A-9. CUMULATIVE NO_X MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF NO_X EMITTED DURING TEST -- 3

HERCULES INC., RUN 3, INLET HV-12, OUTLET HV-13, UNIT A 1408-1812 3/6/75

TIME INTO CYCLE (MIN)	TOTAL NOX IN (GRAMS)	TOTAL NOX ADS. (GRAMS)	NOX USED FOR REGEN. (GRAMS)	TOTAL NOX EMIT. (GRAMS)	% NOX REDUC. DUE TO ADS.	% NOX REDUC. DUE TO REGEN.	AVG. % REDUC. OF NOX	AVG. PPM OF NOX EMIT.
0								
6.0	5413.3	4980.5	79.6	353.2	92.00	1.47	93.49	228
7.0	6335.5	5849.5	89.0	396.9	92.33	1.41	93.74	219
12.0	10946.5	10180.4	138.8	627.4	93.00	1.27	94.27	200
22.0	20003.9	18734.7	228.0	1041.2	93.66	1.14	94.79	180
27.0	24555.1	23056.0	268.8	1230.3	93.89	1.09	94.99	173
37.0	33657.6	31758.0	340.0	1559.6	94.36	1.01	95.37	160
42.0	38232.9	36192.6	365.1	1675.3	94.66	0.95	95.62	151
47.0	42872.6	40697.2	389.1	1786.3	94.93	0.91	95.83	144
52.0	47552.5	45245.2	412.5	1894.8	95.15	0.87	96.02	138
57.0	52361.0	49920.3	436.2	2004.6	95.34	0.83	96.17	133
67.0	62669.6	59949.0	485.7	2234.9	95.66	0.78	96.43	126
72.0	68161.7	65294.7	511.6	2355.4	95.79	0.75	96.54	124
82.0	79394.9	76213.5	567.4	2614.1	95.99	0.71	96.71	121
87.0	84963.3	81611.8	597.5	2754.0	96.06	0.70	96.76	120
97.0	95850.9	92142.3	660.7	3047.9	96.13	0.69	96.82	119
102.0	101225.7	97331.7	693.4	3200.5	96.15	0.69	96.84	119
112.0	112136.0	107858.6	761.1	3516.3	96.19	0.68	96.86	119
117.0	117623.5	113143.8	796.8	3682.9	96.19	0.68	96.87	119
127.0	129526.7	124570.8	880.7	4075.2	96.17	0.68	96.85	120
132.0	133803.4	128666.0	912.7	4224.7	96.16	0.68	96.84	121
144.0	146316.6	140604.9	1014.1	4697.6	96.10	0.69	96.79	123
147.0	149580.2	143518.4	1040.6	4621.1	96.08	0.70	96.77	124
157.0	159426.3	153051.0	1131.0	5244.3	96.09	0.71	96.71	126
162.0	164374.4	157731.7	1177.8	5464.9	95.96	0.72	96.68	127
172.0	174238.6	167045.1	1274.3	5919.3	95.87	0.73	96.60	130
177.0	179138.7	171663.3	1323.5	6151.9	95.83	0.74	96.57	131
182.0	183700.2	175961.1	1373.2	6365.9	95.79	0.75	96.53	132
187.0	186966.9	179027.6	1422.3	6517.1	95.75	0.76	96.51	133
192.0	189033.5	180938.9	1467.2	6627.5	95.72	0.78	96.49	134
197.0	190460.1	182211.9	1508.9	6739.3	95.67	0.79	96.46	134
202.0	191921.3	183524.7	1548.8	6847.8	95.62	0.81	96.43	134
206.0	193139.4	184594.4	1595.4	6949.6	95.58	0.83	96.40	135
207.0	193553.9	184765.7	1611.8	6976.4	95.56	0.83	96.39	135
209.0	193722.0	185070.0	1638.4	7013.7	95.53	0.85	96.38	136
212.0	194220.6	185483.8	1665.6	7071.2	95.50	0.86	96.36	136
217.0	195591.7	186667.9	1705.4	7218.4	95.44	0.87	96.31	136
222.0	197639.0	188514.5	1743.5	7381.0	95.38	0.88	96.27	136
232.0	203269.8	193752.6	1819.7	7697.5	95.32	0.90	96.21	136
244.0	212027.9	202002.9	1914.9	8110.1	95.27	0.90	96.17	136

TABLE A-10. SUMMARY OF CALCULATED NO_X MASS FLOW RATES AND CONTROL EFFICIENCIES FOR INSTANTANEOUS FLOW AND CONCENTRATION DATA FOR TEST -- 4

HERCULES INC., RUN 4, INLET HV-12, OUTLET HV-13, UNIT B 0850-1255 3/7/75

TIME INTO CYCLE (MIN)	INLET FLOW (SCFM)	REGEN. FLOW (SCFM)	INLET CONC. (PPM)	OUTLET CONC. (PPM)	MASS FLOW RATE IN (G/MIN)	MASS FLOW RATE ADS. (G/MIN)	MASS FLOW RATE REGEN. (G/MIN)	MASS FLOW RATE EMIT. (G/MIN)	% REDUC. OF NOX DUE TO ADS.	% REDUC. OF NOX DUE TO REGEN.	% REDUC. OF NOX
0.0	5700	1015	2780	68	871.2	849.9	3.79	17.52	97.55	0.44	97.99
5.0	5700	1015	2760	18	865.0	859.3	1.00	4.64	99.35	0.12	99.46
12.0	5700	1015	2760	75	865.0	841.5	4.19	19.32	97.28	0.48	97.77
25.0	5700	1015	2800	68	877.5	856.2	3.79	17.52	97.57	0.43	98.00
35.0	5700	1015	2500	58	783.5	765.3	3.24	14.94	97.68	0.41	98.09
40.0	5700	1015	2440	58	764.7	746.5	3.24	14.94	97.62	0.42	98.05
50.0	5700	1015	2510	58	786.6	768.4	3.24	14.94	97.69	0.41	98.10
55.0	5700	1015	2600	59	814.8	796.3	3.29	15.20	97.73	0.40	98.13
60.0	5700	1010	2730	62	855.6	836.1	3.44	15.99	97.73	0.40	98.13
70.0	4500	1010	3030	66	749.7	733.3	3.67	12.66	97.82	0.49	98.31
75.0	4450	1000	2320	68	567.6	551.0	3.74	12.90	97.07	0.66	97.73
80.0	4450	1020	1830	65	447.7	431.8	3.65	12.26	95.45	0.81	97.26
82.0	4450	1020	1640	64	401.3	385.6	3.59	12.07	96.10	0.89	96.99
85.0	4475	1020	1610	60	396.1	381.4	3.36	11.40	96.27	0.85	97.12
90.0	4500	1020	1600	56	395.9	382.0	3.14	10.71	96.50	0.79	97.29
97.0	4500	1020	1560	54	386.0	372.6	3.03	10.33	96.54	0.78	97.32
100.0	5625	965	1360	50	420.6	405.1	2.65	12.81	96.32	0.63	96.95
110.0	5675	1000	2970	61	926.7	907.7	3.35	15.68	97.95	0.36	98.31
115.0	5675	1015	3900	74	1216.9	1193.8	4.13	18.96	98.10	0.34	98.44
120.0	5675	1010	4070	86	1269.9	1243.1	4.78	22.06	97.89	0.38	98.26
130.0	5700	1010	4080	109	1278.6	1244.5	6.05	28.11	97.33	0.47	97.80
137.0	5700	1010	4180	121	1310.0	1272.1	6.72	31.20	97.11	0.51	97.62
145.0	5700	1010	4150	138	1300.6	1257.3	7.66	35.59	95.67	0.59	97.26
150.0	5700	1010	4140	149	1297.5	1250.8	8.27	38.42	96.40	0.64	97.04
160.0	5725	1010	3980	162	1252.8	1201.8	9.00	42.00	95.93	0.72	96.65
165.0	5725	1010	3670	175	1155.2	1100.1	9.72	45.37	95.23	0.84	96.07
175.0	5725	1010	3390	179	1067.1	1010.7	9.94	46.40	94.72	0.93	95.65
180.0	5725	1010	3500	181	1101.7	1044.7	10.05	46.92	94.83	0.91	95.74
190.0	5750	1010	3680	198	1163.4	1100.8	11.00	51.60	94.62	0.95	95.56
205.0	5775	1010	3910	222	1241.5	1171.0	12.33	58.16	94.32	0.99	95.32
210.0	5775	1010	3730	232	1184.3	1110.7	12.88	60.78	93.78	1.09	94.87
220.0	5775	1010	3310	238	1051.0	975.4	13.22	62.35	92.81	1.26	94.07
235.0	5800	1010	3260	242	1039.6	962.4	13.44	63.73	92.58	1.29	93.87
245.0	5800	1010	3310	249	1055.5	976.1	13.83	65.58	92.48	1.31	93.79

TABLE A-11. SUMMARY OF NO_x MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF NO_x EMITTED FOR INTERVALS DURING TEST -- 4

HERCULES INC., RUN 4, INLET HV-12, OUTLET HV-13, UNIT B 0850-1255 3/7/75

INTERVAL OF CYCLE (MIN)	NOX IN DURING INTERVAL (GRAMS)	NOX ADSORBED DURING INTERVAL (GRAMS)	NOX REGEN. DURING INTERVAL (GRAMS)	NOX EMITTED DURING INTERVAL (GRAMS)	PERCENT OF NOX ADSORBED DURING INTERVAL	PERCENT NOX FOR REGEN. DURING INTERVAL	PERCENT REDUC. OF NOX DURING INTERVAL	AVERAGE PPM OF NOX EMIT. DURING INTERVAL
0.0- 5.0	4340.5	4273.1	12.00	55.38	98.45	0.28	98.72	43
5.0- 12.0	6054.8	5952.8	18.16	83.84	98.32	0.30	98.62	46
12.0- 25.0	11326.1	11034.8	51.87	239.43	97.43	0.46	97.89	71
25.0- 35.0	8305.0	8107.5	35.16	162.28	97.62	0.42	98.05	63
35.0- 40.0	3870.4	3779.5	16.18	74.70	97.65	0.42	98.07	58
40.0- 50.0	7756.5	7574.7	32.37	149.40	97.66	0.42	98.07	58
50.0- 55.0	4003.6	3911.9	16.32	75.34	97.71	0.41	98.12	59
55.0- 60.0	4176.0	4081.2	16.84	77.96	97.73	0.40	98.13	61
60.0- 70.0	8026.2	7847.4	35.54	143.26	97.77	0.44	98.22	64
70.0- 75.0	3293.3	3210.8	18.51	63.91	97.50	0.56	98.06	67
75.0- 80.0	2538.4	2457.1	18.46	62.89	96.80	0.73	97.52	67
80.0- 82.0	849.0	817.4	7.23	24.33	96.28	0.85	97.13	64
82.0- 85.0	1195.1	1150.4	10.43	35.20	96.18	0.87	97.06	62
85.0- 90.0	1980.0	1908.4	16.26	55.28	96.39	0.82	97.21	58
90.0- 97.0	2734.4	2641.2	21.59	73.66	96.52	0.79	97.31	55
97.0-100.0	1209.9	1166.6	8.52	34.71	96.43	0.70	97.13	52
100.0-110.0	6736.5	6564.0	30.03	142.45	97.44	0.45	97.89	56
110.0-115.0	5358.9	5253.6	18.71	86.60	98.03	0.35	98.38	67
115.0-120.0	6217.0	6092.2	22.26	102.54	97.99	0.36	98.35	80
120.0-130.0	12742.9	12437.9	54.14	250.83	97.61	0.42	98.03	98
130.0-137.0	9060.2	8807.9	44.70	207.58	97.22	0.49	97.71	115
137.0-145.0	10442.3	10117.6	57.53	267.15	96.89	0.55	97.44	129
145.0-150.0	6495.1	6270.2	39.84	185.02	96.54	0.61	97.15	144
150.0-160.0	12751.2	12262.7	86.35	402.09	96.17	0.68	96.85	156
160.0-166.0	7223.9	6935.7	56.14	262.09	95.59	0.78	96.37	169
165.0-175.0	10000.2	9498.8	88.46	412.97	94.99	0.88	95.87	177
175.0-180.0	5421.9	5138.6	49.98	233.31	94.78	0.92	95.70	180
180.0-190.0	11325.5	10727.6	105.23	492.62	94.72	0.93	95.65	190
190.0-205.0	18036.8	17038.6	174.92	823.22	94.47	0.97	95.44	210
205.0-210.0	6064.6	5704.2	63.03	297.35	94.06	1.04	95.10	227
210.0-220.0	11176.6	10430.5	130.50	615.67	93.32	1.17	94.49	235
220.0-235.0	15679.3	14533.7	199.91	945.65	92.69	1.28	93.97	240
235.0-245.0	10475.6	9692.7	136.33	646.55	92.53	1.30	93.83	246

TABLE A-12. CUMULATIVE NO_X MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF NO_X EMITTED DURING TEST -- 4

HERCULES INC., RUN 4, INLET HV-12, OUTLET HV-13, UNIT 8 0850-1255 3/7/75

TIME INTO CYCLE (MIN)	TOTAL NOX IN (GRAMS)	TOTAL NOX ADS. (GRAMS)	NOX USED FOR REGEN. (GRAMS)	TOTAL NOX EMIT. (GRAMS)	% NOX REDUC. DUE TO ADS.	% NOX REDUC. DUE TO REGEN.	AVG. % REDUC. OF NOX	AVG. PPM OF NOX EMIT.
0								
5.0	4340.5	4273.1	12.0	55.4	98.45	0.28	98.72	43
12.0	10395.3	10225.9	30.2	139.2	98.37	0.29	98.66	45
25.0	21721.4	21260.7	82.0	378.7	97.88	0.38	98.26	59
35.0	30026.3	29368.2	117.2	540.9	97.81	0.39	98.20	60
40.0	33896.7	33147.7	133.4	615.6	97.79	0.39	98.18	60
50.0	41653.2	40722.5	165.7	765.0	97.77	0.40	98.16	59
55.0	45656.9	44634.4	182.1	840.4	97.76	0.40	98.16	59
60.0	49832.3	48715.6	198.9	918.3	97.76	0.40	98.16	59
70.0	57859.0	56563.0	234.4	1061.6	97.76	0.41	98.17	60
75.0	61152.3	59773.8	253.0	1125.5	97.75	0.41	98.16	60
80.0	63690.7	62230.9	271.4	1188.4	97.71	0.43	98.13	61
82.0	64539.7	63048.3	278.7	1212.7	97.69	0.43	98.12	61
85.0	65735.8	64198.8	289.1	1247.9	97.66	0.44	98.10	61
90.0	67715.3	66107.2	305.3	1303.2	97.62	0.45	98.08	61
97.0	70452.2	68748.4	326.9	1376.9	97.58	0.46	98.05	60
100.0	71662.1	69915.0	335.5	1411.6	97.56	0.47	98.03	60
110.0	78398.6	76479.1	365.5	1554.0	97.55	0.47	98.02	60
115.0	83757.5	81732.7	384.2	1640.6	97.58	0.46	98.04	60
120.0	89974.5	87824.9	406.5	1743.2	97.61	0.45	98.06	61
130.0	102717.4	100262.8	460.6	1994.0	97.61	0.45	98.06	64
137.0	111777.6	109070.7	505.3	2201.6	97.58	0.45	98.03	67
145.0	122219.9	119188.3	562.8	2468.7	97.52	0.46	97.98	70
150.0	128715.0	125458.6	602.7	2653.8	97.47	0.47	97.94	73
160.0	141466.2	137721.3	689.0	3055.8	97.35	0.49	97.84	78
166.0	148690.1	144627.0	745.2	3317.9	97.27	0.50	97.77	82
175.0	158690.3	154125.8	833.6	3730.9	97.12	0.53	97.65	87
180.0	164112.2	159264.4	883.6	3964.2	97.05	0.54	97.58	90
190.0	175437.7	169552.0	988.8	4456.8	96.90	0.56	97.46	95
205.0	193474.5	187030.6	1163.8	5280.0	96.67	0.60	97.27	104
210.0	199539.1	192734.9	1226.8	5577.4	96.59	0.61	97.20	107
220.0	210715.7	203165.3	1357.3	6193.1	96.42	0.64	97.06	113
235.0	226395.0	217699.1	1557.2	7138.7	96.16	0.69	96.85	122
245.0	236870.6	227391.8	1693.5	7785.3	96.00	0.71	96.71	127

TABLE A-13. SUMMARY OF CALCULATED NO_x MASS FLOW RATES AND CONTROL EFFICIENCIES FOR INSTANTANEOUS FLOW AND CONCENTRATION DATA FOR TEST -- 5

HERCULES INC., RUN 5, INLET HV-12, OUTLET HV-13, UNIT A 1255-1658 3/7/75

TIME INTO CYCLE (MIN)	INLET FLOW (SCFM)	REGEN. FLOW (SCFM)	INLET CONC. (PPM)	OUTLET CONC. (PPM)	MASS FLOW RATE IN (G/MIN)	MASS FLOW RATE ADS. (G/MIN)	MASS FLOW RATE REGEN. (G/MIN)	MASS FLOW RATE EMIT. (G/MIN)	% REDUC. OF NOX DUE TO ADS.	% REDUC. OF NOX DUE TO REGEN.	% REDUC. OF NOX
0.0	5800	1010	3310	249	1055.5	976.1	13.83	65.58	92.48	1.31	93.79
3.0	5575	1015	3330	150	1020.7	974.7	8.37	37.61	95.50	0.82	96.32
5.0	5575	1010	3350	140	1026.8	983.9	7.77	35.14	95.82	0.76	96.58
9.0	5575	1010	3200	129	980.9	941.3	7.16	32.38	95.97	0.73	96.70
13.0	5650	1030	3080	146	956.8	911.4	8.27	37.09	95.26	0.86	96.12
15.0	5650	1025	2960	189	919.5	860.8	10.65	48.06	93.61	1.16	94.77
17.0	5650	1020	2760	235	857.4	784.4	13.18	59.82	91.49	1.54	93.02
20.0	5675	1020	2410	180	752.0	695.8	10.09	46.07	92.53	1.34	93.87
23.0	5675	1020	2340	106	730.1	697.1	5.94	27.13	95.47	0.81	96.28
30.0	5675	1025	2180	72	680.2	657.7	4.06	18.41	96.70	0.60	97.29
35.0	5700	1025	2040	61	639.3	620.2	3.44	15.68	97.01	0.54	97.55
41.0	5700	1025	2060	52	645.6	629.3	2.93	13.37	97.48	0.45	97.93
50.0	5700	1025	2090	49	655.0	639.6	2.76	12.59	97.66	0.42	98.08
65.0	5725	1020	2090	54	657.9	640.9	3.03	13.97	97.42	0.46	97.88
80.0	5725	1020	2050	61	645.3	626.1	3.42	15.78	97.02	0.53	97.55
85.0	5650	1020	2150	64	667.9	648.0	3.59	16.29	97.02	0.54	97.56
95.0	5625	1020	2260	75	699.0	675.8	4.21	18.99	96.68	0.60	97.28
102.0	5625	1020	2340	80	723.7	699.0	4.49	20.26	95.58	0.62	97.20
110.0	5450	1015	2340	81	701.2	676.9	4.52	19.75	96.54	0.64	97.18
115.0	5450	1020	2320	85	695.2	669.7	4.77	20.70	96.34	0.69	97.02
121.0	5450	1020	2290	85	686.2	660.7	4.77	20.70	95.29	0.69	96.98
125.0	5450	1020	2260	86	677.2	651.4	4.82	20.95	96.19	0.71	96.91
140.0	5450	1020	2250	92	674.2	646.6	5.16	22.41	95.91	0.77	96.68
148.0	5450	1020	2250	95	674.2	645.7	5.33	23.14	95.78	0.79	96.57
155.0	5450	1020	2220	99	665.2	635.6	5.55	24.11	95.54	0.83	96.38
163.0	5450	1020	2150	105	644.2	612.8	5.89	25.57	95.12	0.91	96.03
170.0	5450	1020	2160	110	647.2	614.3	6.17	26.79	94.91	0.95	95.86
185.0	5500	1020	1890	114	571.5	537.1	6.39	28.08	93.97	1.12	95.09
190.0	5500	1020	2090	115	632.0	597.2	6.45	28.33	94.50	1.02	95.52
200.0	5550	1020	2200	120	671.3	634.7	6.73	29.89	94.55	1.00	95.55
205.0	5550	1020	2200	125	671.3	633.2	7.01	31.13	94.32	1.04	95.36
211.0	5500	1020	2200	129	665.3	626.3	7.23	31.77	94.14	1.09	95.22
215.0	5525	1020	2200	130	668.3	628.8	7.29	32.20	94.09	1.09	95.18
230.0	5550	1020	2260	134	689.6	648.7	7.51	33.37	94.07	1.09	95.16
235.0	5550	1020	2300	138	701.[illegible]	659.7	7.74	34.37	94.00	1.10	95.10
243.0	5550	1020	2310	140	704.9	662.2	7.85	34.87	93.94	1.11	95.05

TABLE A-14. SUMMARY OF NO_X MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF NO_X EMITTED FOR INTERVALS DURING TEST -- 5

HERCULES INC., RUN 5, INLET HV-12, OUTLET HV-13, UNIT A 1255-1658 3/7/75

INTERVAL OF CYCLE (MIN)	NOX IN DURING INTERVAL (GRAMS)	NOX ADSORBED DURING INTERVAL (GRAMS)	NOX REGEN. DURING INTERVAL (GRAMS)	NOX EMITTED DURING INTERVAL (GRAMS)	PERCENT OF NOX ADSORBED DURING INTERVAL	PERCENT NOX FOR REGEN. DURING INTERVAL	PERCENT REDUC. OF NOX DURING INTERVAL	AVERAGE PPM OF NOX EMIT. DURING INTERVAL
0.0- 3.0	3114.4	2926.3	33.30	154.78	93.96	1.07	95.03	201
3.0- 5.0	2047.6	1958.7	16.15	72.75	95.66	0.79	96.45	145
5.0- 9.0	4015.4	3850.5	29.88	135.03	95.89	0.74	96.64	135
9.0- 13.0	3875.3	3705.5	30.86	138.93	95.62	0.80	96.42	138
13.0- 15.0	1876.3	1772.2	18.92	85.15	94.45	1.01	95.46	168
15.0- 17.0	1776.9	1645.2	23.83	107.88	92.59	1.34	93.93	212
17.0- 20.0	2414.0	2220.3	34.91	158.84	91.97	1.45	93.42	207
20.0- 23.0	2223.1	2089.3	24.06	109.80	93.98	1.08	95.06	143
23.0- 30.0	4936.2	4741.8	35.01	159.38	96.06	0.71	96.77	89
30.0- 35.0	3298.8	3194.9	18.74	85.22	96.85	0.57	97.42	66
35.0- 41.0	3854.8	3748.5	19.10	87.14	97.24	0.50	97.74	57
41.0- 50.0	5852.6	5710.2	25.61	116.82	97.57	0.44	98.00	51
50.0- 65.0	9846.5	9603.8	43.42	199.23	97.54	0.44	97.98	52
65.0- 80.0	9773.6	9502.1	48.37	223.12	97.22	0.49	97.72	57
80.0- 85.0	3282.9	3185.2	17.53	80.18	97.02	0.53	97.56	62
85.0- 95.0	6834.2	6618.8	38.98	176.41	96.85	0.57	97.42	69
95.0-102.0	4979.3	4811.5	30.42	137.36	96.63	0.61	97.24	78
102.0-110.0	5699.5	5503.4	36.03	160.03	96.56	0.63	97.19	80
110.0-115.0	3490.9	3366.6	23.22	101.14	96.44	0.67	97.10	83
115.0-121.0	4144.1	3991.3	28.60	124.22	96.31	0.69	97.00	85
121.0-125.0	2726.8	2624.3	19.18	83.30	96.24	0.70	96.95	86
125.0-140.0	10135.6	9735.6	74.87	325.16	96.05	0.74	96.79	89
140.0-148.0	5393.7	5169.5	41.95	182.19	95.84	0.78	96.62	94
148.0-155.0	4683.0	4484.5	38.08	165.38	95.65	0.81	96.47	97
155.0-163.0	5237.9	4993.3	45.76	198.75	95.33	0.87	96.21	102
163.0-170.0	4520.2	4294.7	42.20	183.28	95.01	0.93	95.95	108
170.0-185.0	9140.8	8635.0	94.22	411.54	94.47	1.03	95.50	112
185.0-190.0	3008.9	2835.7	32.11	141.02	94.25	1.07	95.31	115
190.0-200.0	6516.7	6159.7	65.90	291.07	94.52	1.01	95.53	118
200.0-205.0	3356.6	3169.7	34.35	152.55	94.43	1.02	95.46	123
205.0-211.0	4009.8	3778.3	42.73	188.72	94.23	1.07	95.29	127
211.0-215.0	2667.2	2510.2	29.05	127.95	94.11	1.09	95.20	130
215.0-230.0	10184.5	9581.6	111.04	491.81	94.08	1.09	95.17	132
230.0-235.0	3478.7	3271.2	38.14	169.36	94.04	1.10	95.13	136
235.0-243.0	5626.9	5287.6	62.36	276.96	93.97	1.11	95.08	139

TABLE A-15. CUMULATIVE NO_X MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF NO_X EMITTED DURING TEST -- 5

HERCULES INC., RUN 5, INLET HV-12, OUTLET HV-13, UNIT A 1255-1658 3/7/75

TIME INTO CYCLE (MIN)	TOTAL NOX IN (GRAMS)	TOTAL NOX ADS. (GRAMS)	NOX USED FOR REGEN. (GRAMS)	TOTAL NOX EMIT. (GRAMS)	% NOX REDUC. DUE TO ADS.	% NOX REDUC. DUE TO REGEN.	AVG. % REDUC. OF NOX	AVG. PPM OF NOX EMIT.
0								
3.0	3114.4	2926.3	33.3	154.8	93.96	1.07	95.03	201
5.0	5161.9	4885.0	49.4	227.5	94.63	0.96	95.59	179
9.0	9177.4	8735.5	79.3	362.6	95.19	0.86	96.05	159
13.0	13052.7	12441.0	110.2	501.5	95.31	0.84	96.16	153
15.0	14929.0	14213.3	129.1	586.6	95.21	0.86	96.07	155
17.0	16705.9	15858.4	152.9	694.5	94.93	0.92	95.84	161
20.0	19119.9	18078.7	187.8	853.4	94.55	0.98	95.54	168
23.0	21343.0	20168.0	211.9	963.1	94.49	0.99	95.49	165
30.0	26279.2	24909.8	246.9	1122.5	94.79	0.94	95.73	147
35.0	29578.0	28104.6	265.6	1207.7	95.02	0.90	95.92	136
41.0	33432.3	31853.1	284.8	1294.9	95.28	0.85	96.13	124
50.0	39285.4	37563.3	310.4	1411.7	95.62	0.79	96.41	111
65.0	49131.9	47167.1	353.8	1610.9	96.00	0.72	96.72	97
80.0	58905.4	55669.2	402.2	1834.1	96.20	0.68	96.89	89
85.0	62183.3	59854.4	419.7	1914.2	96.25	0.67	96.92	88
95.0	69022.5	66473.2	458.7	2090.6	96.31	0.66	96.97	86
102.0	74001.3	71284.7	489.1	2228.0	96.33	0.66	96.99	85
110.0	79701.3	76788.1	525.1	2388.0	96.34	0.66	97.00	85
115.0	83192.2	80154.7	548.3	2489.2	96.35	0.66	97.01	85
121.0	87336.3	84146.0	576.9	2613.4	96.35	0.66	97.01	85
125.0	90063.1	86770.3	596.1	2696.7	96.34	0.66	97.01	85
140.0	100198.3	96505.9	671.0	3021.8	96.31	0.67	96.98	85
148.0	105592.4	101675.5	712.9	3204.0	96.29	0.68	96.97	86
155.0	110280.4	106160.0	751.0	3369.4	96.26	0.68	96.94	86
163.0	115513.3	111153.4	796.8	3568.2	96.22	0.69	96.91	87
170.0	120038.5	115448.1	839.0	3751.5	96.18	0.70	96.87	88
185.0	129179.3	124083.1	933.2	4163.0	96.05	0.72	96.78	90
190.0	132183.2	126918.9	965.3	4304.0	96.01	0.73	96.74	90
200.0	138704.9	133078.6	1031.2	4595.1	95.94	0.74	96.69	92
205.0	142061.5	136248.3	1065.5	4747.6	95.91	0.75	96.66	92
211.0	146071.3	140026.6	1108.3	4936.4	95.86	0.76	96.62	93
215.0	148738.4	142536.8	1137.3	5064.3	95.83	0.76	96.60	94
230.0	158922.9	152118.4	1248.4	5556.1	95.72	0.79	96.50	97
235.0	162401.6	155389.6	1286.5	5725.5	95.68	0.79	96.47	97
243.0	168028.5	160677.2	1348.9	6002.4	95.62	0.80	96.43	99

TABLE A-16. SUMMARY OF CALCULATED NO_X MASS FLOW RATES AND CONTROL EFFICIENCIES FOR INSTANTANEOUS FLOW AND CONCENTRATION DATA FOR TEST -- 6

HERCULES INC., RUN 6, INLET HV-12, OUTLET HV-13, UNIT A 1400-1754 3/11/75

TIME INTO CYCLE (MIN)	INLET FLOW (SCFM)	REGEN. FLOW (SCFM)	INLET CONC. (PPM)	OUTLET CONC. (PPM)	MASS FLOW RATE IN (G/MIN)	MASS FLOW RATE ADS. (G/MIN)	MASS FLOW RATE REGEN. (G/MIN)	MASS FLOW RATE EMIT. (G/MIN)	% REDUC. OF NOX DUE TO ADS.	% REDUC. OF NOX DUE TO REGEN.	% REDUC. OF NOX
0.0	3150	1030	1150	8	199.2	197.8	0.45	0.93	99.30	0.23	99.53
15.0	4250	1035	1060	11	247.7	245.1	0.63	1.94	98.96	0.25	99.21
20.0	4300	1035	890	10	210.4	208.0	0.57	1.80	98.88	0.27	99.15
30.0	4350	1030	750	10	179.4	177.0	0.57	1.83	98.67	0.32	98.98
35.0	4350	1030	720	8	172.2	170.3	0.45	1.46	98.89	0.26	99.15
45.0	4350	1030	710	6	169.8	168.4	0.34	1.10	99.15	0.20	99.36
50.0	4350	1030	710	6	169.8	168.4	0.34	1.10	99.15	0.20	99.36
60.0	4350	1030	710	9	169.8	167.7	0.51	1.64	98.73	0.30	99.03
65.0	4350	1030	710	9	169.8	167.7	0.51	1.64	98.73	0.30	99.03
75.0	4350	1030	710	10	169.8	167.4	0.57	1.83	98.59	0.33	98.93
80.0	4350	1030	680	10	162.6	160.2	0.57	1.83	98.53	0.35	98.88
90.0	5200	1025	800	10	228.7	225.9	0.56	2.30	98.75	0.25	99.00
95.0	5175	1025	880	11	250.4	247.3	0.62	2.51	98.75	0.25	99.00
105.0	5175	1025	970	14	276.0	272.0	0.79	3.19	98.56	0.29	98.84
110.0	5175	1025	1020	14	290.2	286.2	0.79	3.19	98.63	0.27	98.90
120.0	5200	1025	1190	15	340.2	335.9	0.85	3.44	98.74	0.25	98.99
125.0	5200	1025	1230	16	351.7	347.1	0.90	3.67	98.70	0.26	98.96
130.0	5200	1025	1260	18	360.2	355.1	1.01	4.13	98.57	0.28	98.85
140.0	5200	1025	1260	16	360.2	355.7	0.90	3.67	98.73	0.25	98.98
150.0	5200	1025	1200	20	343.1	337.4	1.13	4.59	98.33	0.33	98.66
165.0	5200	1025	1150	21	328.8	322.8	1.18	4.82	98.17	0.36	98.53
170.0	5200	1025	1150	21	328.8	322.8	1.18	4.82	98.17	0.36	98.53
180.0	5200	1025	1140	24	325.9	319.1	1.35	5.51	97.89	0.41	98.31
195.0	5175	1025	1140	25	324.4	317.2	1.41	5.70	97.81	0.43	98.24
200.0	5175	1025	1150	29	327.2	319.0	1.63	6.62	97.48	0.50	97.98
210.0	5175	1025	1150	29	327.2	319.0	1.63	6.62	97.48	0.50	97.98
225.0	5175	1025	1130	29	321.5	313.3	1.63	6.62	97.43	0.51	97.94
230.0	5175	1025	1110	29	315.8	307.6	1.63	6.62	97.39	0.52	97.90
234.0	5175	1025	1090	29	310.1	301.9	1.63	6.62	97.34	0.53	97.87

TABLE A-17. SUMMARY OF NO_X MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF NO_X EMITTED FOR INTERVALS DURING TEST -- 6

HERCULES INC., RUN 6, INLET HV-12, OUTLET HV-13, UNIT A 1400-1754 3/11/75

INTERVAL OF CYCLE (MIN)	NOX IN DURING INTERVAL (GRAMS)	NOX ADSORBED DURING INTERVAL (GRAMS)	NOX REGEN. DURING INTERVAL (GRAMS)	NOX EMITTED DURING INTERVAL (GRAMS)	PERCENT OF NOX ADSORBED DURING INTERVAL	PERCENT NOX FOR REGEN. DURING INTERVAL	PERCENT REDUC. OF NOX DURING INTERVAL	AVERAGE PPM OF NOX EMIT. DURING INTERVAL
0.0- 15.0	3351.5	3321.8	8.39	21.58	99.11	0.24	99.36	10
15.0- 20.0	1145.3	1132.9	2.99	9.35	98.92	0.26	99.18	10
20.0- 30.0	1949.0	1925.2	5.68	18.10	98.78	0.29	99.07	10
30.0- 35.0	873.9	864.2	2.55	8.21	98.78	0.29	99.07	9
35.0- 45.0	1710.1	1693.3	3.96	12.78	99.02	0.23	99.25	7
45.0- 50.0	849.1	841.9	1.70	5.48	99.15	0.20	99.36	6
50.0- 60.0	1698.1	1680.2	4.25	13.69	98.94	0.25	99.19	7
60.0- 65.0	849.1	838.3	2.55	8.21	98.73	0.30	99.03	9
65.0- 75.0	1698.1	1675.4	5.38	17.34	98.66	0.32	98.98	9
75.0- 80.0	831.1	819.2	2.83	9.13	98.56	0.34	98.90	10
80.0- 90.0	1956.8	1930.5	5.65	20.60	98.66	0.29	98.95	10
90.0- 95.0	1197.8	1182.8	2.96	12.01	98.75	0.25	99.00	10
95.0-105.0	2631.9	2596.3	7.04	28.52	98.65	0.27	98.92	12
105.0-110.0	1415.5	1395.6	3.94	15.97	98.59	0.28	98.87	14
110.0-120.0	3152.2	3110.9	8.17	33.19	98.69	0.26	98.95	15
120.0-125.0	1729.7	1707.6	4.37	17.79	98.72	0.25	98.97	15
125.0-135.0	3559.5	3510.9	9.58	39.02	98.63	0.27	98.90	17
135.0-140.0	1931.2	1776.9	4.79	19.51	98.65	0.27	98.92	17
140.0-150.0	3515.6	3465.2	10.14	41.32	98.54	0.29	98.83	18
150.0-165.0	5039.1	4951.1	17.33	70.59	98.26	0.34	98.60	21
165.0-170.0	1643.9	1613.9	5.92	24.10	98.17	0.36	98.53	21
170.0-180.0	3273.6	3209.3	12.68	51.65	98.03	0.39	98.42	23
180.0-195.0	4877.2	4772.4	20.71	84.10	97.85	0.42	98.28	24
195.0-200.0	1623.9	1590.5	7.61	30.80	97.64	0.47	98.11	27
200.0-210.0	3272.1	3189.6	16.34	66.17	97.48	0.50	97.98	29
210.0-225.0	4865.4	4741.7	24.51	99.26	97.46	0.50	97.96	29
225.0-230.0	1593.4	1552.1	8.17	33.09	97.41	0.51	97.92	29
230.0-234.0	1251.9	1218.9	6.54	26.47	97.36	0.52	97.89	29

TABLE A-18. CUMULATIVE NO_x MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF NO_x EMITTED DURING TEST -- 6

HERCULES INC., RUN 6, INLET HV-12, OUTLET HV-13, UNIT A 1400-1754 3/11/75

TIME INTO CYCLE (MIN)	TOTAL NOX IN (GRAMS)	TOTAL NOX ADS. (GRAMS)	NOX USED FOR REGEN. (GRAMS)	TOTAL NOX EMIT. (GRAMS)	% NOX REDUC. DUE TO ADS.	% NOX REDUC. DUE TO REGEN.	AVG. % REDUC. OF NOX	AVG. PPM OF NOX EMIT.
0								
15.0	3351.5	3321.8	8.1	21.6	99.11	0.24	99.36	10
20.0	4496.7	4454.7	11.1	30.9	99.07	0.25	99.31	10
30.0	6445.7	6379.9	16.8	49.0	98.98	0.26	99.24	10
35.0	7324.6	7248.1	19.3	57.2	98.95	0.26	99.22	10
45.0	9034.7	8941.4	23.3	70.0	98.97	0.26	99.22	9
50.0	9883.7	9783.3	25.0	75.5	98.98	0.25	99.24	9
60.0	11581.8	11463.4	29.2	89.2	98.98	0.25	99.23	9
65.0	12430.9	12301.7	31.8	97.4	98.96	0.26	99.22	9
75.0	14129.0	13977.1	37.1	114.7	98.93	0.26	99.19	9
80.0	14960.1	14796.3	40.0	123.9	98.90	0.27	99.17	9
90.0	16916.9	16726.8	45.6	144.5	98.88	0.27	99.15	9
95.0	18114.7	17909.6	48.6	156.5	98.87	0.27	99.14	9
105.0	20746.6	20505.9	55.6	185.0	98.84	0.27	99.11	9
110.0	22162.1	21901.6	59.6	201.0	98.82	0.27	99.09	10
120.0	25314.3	25012.4	67.7	234.2	98.81	0.27	99.07	10
125.0	27044.0	26720.0	72.1	252.0	98.80	0.27	99.07	10
135.0	30603.5	30230.9	81.7	291.0	98.78	0.27	99.05	11
140.0	32404.7	32007.8	86.5	310.5	98.77	0.27	99.04	11
150.0	35921.4	35472.9	96.6	351.8	98.75	0.27	99.02	12
165.0	40960.4	40424.1	114.0	422.4	98.69	0.28	98.97	13
170.0	42604.4	42038.0	119.9	446.5	98.67	0.28	98.95	13
180.0	45878.0	45247.2	132.6	498.1	98.63	0.29	98.91	14
195.0	51755.2	50019.6	153.3	582.2	98.55	0.30	98.85	15
200.0	52384.1	51610.2	160.9	613.1	98.52	0.31	98.83	15
210.0	55656.2	54799.7	177.2	679.2	98.46	0.32	98.78	16
225.0	60521.6	59541.4	201.7	778.5	98.38	0.33	98.71	17
230.0	62115.0	61093.5	209.9	811.6	98.36	0.34	98.69	17
234.0	63366.9	62312.4	216.4	838.0	98.34	0.34	98.68	17

TABLE A-19. SUMMARY OF CALCULATED NO_X MASS FLOW RATES AND CONTROL EFFICIENCIES FOR INSTANTANEOUS FLOW AND CONCENTRATION DATA FOR TEST -- 7

HERCULES INC., RUN 7, INLET HV-12, OUTLET HV-13, UNIT B 1002-1404 3/12/75

TIME INTO CYCLE (MIN)	INLET FLOW (SCFM)	REGEN. FLOW (SCFM)	INLET CONC. (PPM)	OUTLET CONC. (PPM)	MASS FLOW RATE IN (G/MIN)	MASS FLOW RATE ADS. (G/MIN)	MASS FLOW RATE REGEN. (G/MIN)	MASS FLOW RATE EMIT. (G/MIN)	% REDUC. OF NOX DUE TO ADS.	% REDUC. OF NOX DUE TO REGEN.	% REDUC. OF NOX
0.0	4300	1025	1950	78	461.0	442.6	4.40	14.05	96.00	0.95	96.95
1.0	4300	1025	1910	48	451.6	440.2	2.71	8.64	97.49	0.60	98.09
7.0	4300	1025	2030	54	479.9	467.2	3.04	9.72	97.34	0.63	97.97
12.0	4300	1025	2080	58	491.8	478.0	3.27	10.44	97.21	0.66	97.88
20.0	4300	1025	2100	68	496.5	480.4	3.83	12.24	96.76	0.77	97.53
25.0	4300	1025	2050	68	484.7	468.6	3.83	12.24	96.58	0.79	97.47
38.0	4300	1025	2100	46	496.5	485.6	2.59	8.28	97.81	0.52	98.33
43.0	4300	1025	2150	46	508.3	497.4	2.59	8.28	97.86	0.51	98.37
48.0	4300	1025	2170	46	513.0	502.2	2.59	8.28	97.88	0.51	98.39
58.0	4300	1025	2250	46	531.9	521.1	2.59	8.28	97.96	0.49	98.44
78.0	4300	1025	2650	50	626.5	614.7	2.82	9.00	98.11	0.45	98.56
80.0	4300	1025	2690	50	636.0	624.1	2.82	9.00	98.14	0.44	98.58
84.0	4300	1025	2770	49	654.5	643.3	2.76	8.82	98.23	0.42	98.65
88.0	4300	1025	2710	52	640.7	628.4	2.93	9.36	98.08	0.46	98.54
93.0	4300	1020	2690	61	636.0	621.5	3.42	11.00	97.73	0.54	98.27
103.0	4300	1020	2750	61	650.2	635.7	3.42	11.00	97.78	0.53	98.31
108.0	4300	1020	2600	62	614.7	600.0	3.48	11.18	97.62	0.57	98.18
118.0	4300	1020	2480	61	586.3	571.9	3.42	11.00	97.54	0.58	98.12
133.0	4300	1020	2290	59	541.4	527.5	3.31	10.64	97.42	0.61	98.03
138.0	4300	1020	2300	59	543.8	529.8	3.31	10.64	97.43	0.61	98.04
148.0	4300	1020	2280	60	539.0	524.9	3.36	10.82	97.37	0.62	97.99
153.0	4300	1020	2240	62	529.6	514.9	3.48	11.18	97.23	0.66	97.89
163.0	4300	1020	2260	64	534.3	519.2	3.59	11.54	97.17	0.67	97.84
173.0	4300	1020	2320	70	548.5	531.9	3.93	12.62	96.98	0.72	97.70
178.0	4325	1020	2350	71	558.8	541.9	3.98	12.90	96.98	0.71	97.69
183.0	4325	1020	2390	72	568.3	551.2	4.04	13.08	96.99	0.71	97.70
194.0	4325	1020	2280	74	542.2	524.6	4.15	13.45	96.75	0.77	97.52
198.0	4325	1020	2330	76	554.1	536.0	4.26	13.81	96.74	0.77	97.51
203.0	4325	1020	2210	78	525.5	507.0	4.37	14.17	96.47	0.83	97.30
208.0	4325	1020	2190	78	520.8	502.2	4.37	14.17	96.44	0.84	97.28
213.0	4850	1015	2190	76	584.0	563.7	4.24	16.02	96.53	0.73	97.26
223.0	5225	1020	2160	75	620.5	599.0	4.21	17.34	96.53	0.68	97.21
229.0	5225	1020	2280	81	655.0	631.7	4.54	18.73	96.45	0.69	97.14
238.0	5225	1020	2740	92	787.1	765.7	5.16	21.27	96.64	0.66	97.30
242.0	5200	1020	2740	95	783.4	756.2	5.33	21.83	96.53	0.68	97.21

TABLE A-20. SUMMARY OF NO_X MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF NO_X EMITTED FOR INTERVALS DURING TEST -- 7

HERCULES INC., RUN 7, INLET HV-12, OUTLET HV-13, UNIT B 1002-1404 3/12/75

INTERVAL OF CYCLE (MIN)	NOX IN DURING INTERVAL (GRAMS)	NOX ADSORBED DURING INTERVAL (GRAMS)	NOX REGEN. DURING INTERVAL (GRAMS)	NOX EMITTED DURING INTERVAL (GRAMS)	PERCENT OF NOX ADSORBED DURING INTERVAL	PERCENT NOX FOR REGEN. DURING INTERVAL	PERCENT REDUC. OF NOX DURING INTERVAL	AVERAGE PPM OF NOX EMIT. DURING INTERVAL
0.0- 1.0	456.3	441.4	3.55	11.34	96.74	0.78	97.51	63
1.0- 7.0	2794.5	2722.1	17.24	55.10	97.41	0.62	98.03	51
7.0- 12.0	2429.2	2363.0	15.78	50.42	97.27	0.65	97.92	56
12.0- 20.0	3952.9	3833.8	28.40	90.75	96.99	0.72	97.70	63
20.0- 25.0	2452.9	2372.5	19.16	61.22	96.72	0.78	97.50	68
25.0- 38.0	6377.4	6202.2	41.76	133.43	97.25	0.65	97.91	57
38.0- 43.0	2512.0	2457.6	12.96	41.41	97.84	0.52	98.35	46
43.0- 48.0	2553.3	2499.0	12.96	41.41	97.87	0.51	98.38	46
48.0- 58.0	5224.9	5116.1	25.92	82.83	97.92	0.50	98.41	46
58.0- 78.0	11584.6	11357.6	54.10	172.86	98.04	0.47	98.51	48
78.0- 80.0	1262.5	1238.8	5.64	18.01	98.13	0.45	98.57	50
80.0- 84.0	2581.7	2534.9	11.16	35.65	98.19	0.43	98.62	49
84.0- 88.0	2591.2	2543.4	11.38	36.37	98.15	0.44	98.60	50
88.0- 98.0	6383.3	6249.8	31.76	101.82	97.91	0.50	98.40	57
98.0-103.0	3215.3	3143.2	17.10	55.00	97.76	0.53	98.29	61
103.0-108.0	3162.1	3089.4	17.24	55.45	97.70	0.55	98.25	62
108.0-118.0	6005.1	5859.7	34.49	110.91	97.58	0.57	98.15	62
118.0-133.0	8457.9	8245.2	50.47	162.31	97.48	0.60	98.08	60
133.0-138.0	2712.9	2643.2	16.54	53.20	97.43	0.61	98.04	59
138.0-148.0	5414.0	5273.4	33.37	107.30	97.40	0.62	98.02	60
148.0-153.0	2671.6	2599.4	17.10	55.00	97.30	0.64	97.94	61
153.0-163.0	5319.5	5170.5	35.33	113.61	97.20	0.66	97.86	63
163.0-173.0	5414.0	5255.6	37.57	120.83	97.07	0.69	97.77	67
173.0-178.0	2754.3	2684.7	19.77	63.81	96.98	0.71	97.69	71
178.0-183.0	2817.9	2732.9	20.05	64.96	96.98	0.71	97.69	71
183.0-194.0	6107.8	5916.8	45.03	145.92	96.87	0.74	97.61	73
194.0-198.0	2192.5	2121.1	16.82	54.51	96.75	0.77	97.51	75
198.0-203.0	2699.0	2607.4	21.59	69.96	96.61	0.80	97.41	77
203.0-208.0	2615.7	2523.0	21.87	70.87	96.45	0.84	97.29	78
208.0-213.0	2761.9	2664.9	21.54	75.50	96.49	0.78	97.27	77
213.0-223.0	6022.5	5813.5	42.24	166.82	96.53	0.70	97.23	75
223.0-229.0	3826.5	3692.1	26.25	108.20	96.49	0.69	97.17	78
229.0-238.0	6489.6	6266.0	43.66	179.99	96.55	0.67	97.23	86
238.0-242.0	3141.0	3033.9	20.97	86.21	96.59	0.67	97.26	93

TABLE A-21. CUMULATIVE NO_x MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF NO_x EMITTED DURING TEST -- 7

HERCULES INC., RUN 7, INLET HV-12, OUTLET HV-13, UNIT 8 1002-1404 3/12/75

TIME INTO CYCLE (MIN)	TOTAL NOX IN (GRAMS)	TOTAL NOX ADS. (GRAMS)	NOX USED FOR REGEN. (GRAMS)	TOTAL NOX EMIT. (GRAMS)	% NOX REDUC. DUE TO ADS.	% NOX REDUC. DUE TO REGEN.	AVG. % REDUC. OF NOX	AVG. PPM OF NOX EMIT.
0								
1.0	456.3	441.4	3.6	11.3	96.74	0.78	97.51	63
7.0	3250.8	3163.5	20.8	66.4	97.32	0.64	97.96	53
12.0	5680.0	5526.6	36.6	116.9	97.30	0.64	97.94	54
20.0	9632.9	9360.4	65.0	207.6	97.17	0.67	97.84	58
25.0	12085.8	11732.8	84.1	268.8	97.08	0.70	97.78	60
38.0	18463.2	17935.1	125.9	402.3	97.14	0.68	97.82	59
43.0	20975.2	20392.7	138.9	443.7	97.22	0.66	97.88	57
48.0	23528.5	22891.6	151.8	485.1	97.29	0.65	97.94	56
58.0	28753.4	28007.8	177.7	567.9	97.41	0.62	98.02	54
78.0	40338.0	39365.4	231.8	740.8	97.59	0.57	98.16	53
83.0	41600.5	40604.2	237.5	758.8	97.61	0.57	98.18	53
84.0	44182.2	43139.1	248.6	794.4	97.64	0.56	98.20	53
88.0	46773.4	45682.6	260.0	830.8	97.67	0.56	98.22	52
98.0	53156.7	51932.3	291.8	932.6	97.70	0.55	98.25	53
103.0	56372.1	55075.5	308.9	987.6	97.70	0.55	98.25	53
108.0	59534.2	58165.0	[illegible]26.1	1043.1	97.70	0.55	98.25	54
118.0	65539.3	64024.6	[illegible]0.6	1154.0	97.69	0.55	98.24	54
133.0	73997.2	72269.8	411.1	1316.3	97.67	0.56	98.22	55
138.0	76710.1	74913.0	427.6	1369.5	97.66	0.56	98.21	55
148.0	82124.1	80186.3	461.0	1476.8	97.64	0.56	98.20	55
153.0	84795.7	82785.8	478.1	1531.8	97.63	0.56	98.19	56
163.0	90115.1	87956.3	513.4	1645.4	97.60	0.57	98.17	56
173.0	95529.2	93211.9	551.0	1766.3	97.57	0.58	98.15	57
178.0	98297.5	95896.6	570.8	1830.1	97.56	0.58	98.14	57
183.0	101115.3	98629.5	590.8	1895.0	97.54	0.58	98.13	57
194.0	107223.1	104546.3	635.9	2040.9	97.50	0.59	98.10	58
198.0	109415.5	106667.4	652.7	2095.5	97.49	0.60	98.08	59
203.0	112114.5	109274.8	674.3	2165.4	97.47	0.60	98.07	59
208.0	114730.3	111797.8	696.2	2236.3	97.44	0.61	98.05	60
213.0	117492.2	114462.7	717.7	2311.8	97.42	0.61	98.03	60
223.0	123514.7	120276.1	759.9	2478.6	97.38	0.62	97.99	61
229.0	127341.2	123968.2	786.2	2586.8	97.35	0.62	97.97	61
238.0	133830.8	130234.2	829.8	2766.8	97.31	0.62	97.93	63
242.0	136971.9	133268.1	850.8	2853.0	97.30	0.62	97.92	63

TABLE A-22. SUMMARY OF CALCULATED NO_X MASS FLOW RATES AND CONTROL EFFICIENCIES FOR INSTANTANEOUS FLOW AND CONCENTRATION DATA FOR TEST -- 8

HERCULES INC., RUN 8, INLET HV-12, OUTLET HV-13, UNIT A 1404-1806 3/12/75

TIME INTO CYCLE (MIN)	INLET FLOW (SCFM)	REGEN. FLOW (SCFM)	INLET CONC. (PPM)	OUTLET CONC. (PPM)	MASS FLOW RATE IN (G/MIN)	MASS FLOW RATE ADS. (G/MIN)	MASS FLOW RATE REGEN. (G/MIN)	MASS FLOW RATE EMIT. (G/MIN)	% REDUC. OF NOX DUE TO ADS.	% REDUC. OF NOX DUE TO REGEN.	% REDUC. OF NOX
0.0	5200	1020	2740	95	783.4	756.2	5.33	21.83	96.53	0.68	97.21
2.0	5200	1020	2730	50	780.5	766.2	2.80	11.49	98.17	0.36	98.53
5.0	5050	1020	2720	45	755.2	742.7	2.52	9.97	98.35	0.33	98.68
11.0	5050	1020	2630	56	730.2	714.7	3.14	12.41	97.87	0.43	98.30
15.0	5050	1020	2480	76	688.6	667.5	4.26	16.84	95.94	0.62	97.55
18.0	5050	1020	2440	84	677.5	654.2	4.71	18.61	96.56	0.70	97.25
26.0	5025	1020	2350	58	649.3	633.2	3.25	12.77	97.53	0.50	98.03
31.0	5050	1020	2270	49	630.3	616.7	2.75	10.86	97.84	0.44	98.28
41.0	5050	1020	2340	46	649.7	636.9	2.58	10.19	98.03	0.40	98.43
45.0	5050	1020	2380	45	660.8	648.3	2.52	9.97	98.11	0.38	98.49
56.0	5050	1020	2350	45	652.5	640.0	2.52	9.97	98.09	0.39	98.47
72.0	5350	1020	2280	51	633.1	618.9	2.86	11.30	97.76	0.45	98.21
76.0	5050	1020	2270	51	630.3	616.1	2.86	11.30	97.75	0.45	98.21
85.0	5050	1020	2340	56	649.7	634.2	3.14	12.41	97.61	0.48	98.09
101.0	5375	1020	2410	61	672.5	655.4	3.42	13.60	97.47	0.51	97.98
115.0	5025	1020	2520	70	696.2	676.9	3.93	15.41	97.22	0.56	97.79
131.0	5025	1020	2520	71	696.2	676.6	3.98	15.63	97.18	0.57	97.75
136.0	5025	1020	2460	72	679.7	659.8	4.04	15.85	97.07	0.59	97.67
145.0	5025	1020	2180	75	602.3	581.6	4.21	16.52	96.56	0.70	97.26
154.0	5025	1020	2060	76	569.1	548.1	4.26	16.74	96.31	0.75	97.06
161.0	5025	1020	2050	78	566.4	544.8	4.37	17.18	96.20	0.77	96.97
176.0	5025	1020	2050	84	566.4	543.2	4.71	18.50	95.90	0.83	96.73
192.0	5025	1020	2040	91	563.6	538.5	5.10	20.04	95.54	0.91	96.44
196.0	5025	1020	2060	91	569.1	544.0	5.10	20.04	95.58	0.90	96.48
205.0	5025	1020	2190	96	605.1	578.5	5.38	21.14	95.62	0.89	96.51
216.0	5000	1020	2540	106	698.3	669.1	5.94	23.20	95.83	0.85	96.68
221.0	4975	1020	2590	114	708.5	677.3	6.39	24.79	95.60	0.90	96.50
227.0	4975	1020	2560	120	700.2	667.4	6.73	26.09	95.31	0.96	96.27
236.0	4975	1020	2150	121	588.1	555.0	6.79	26.31	94.37	1.15	95.53
242.0	4975	1020	2310	121	631.9	598.8	6.79	26.31	94.76	1.07	95.84

TABLE A-23. SUMMARY OF NO_X MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF NO_X EMITTED FOR INTERVALS DURING TEST -- 8

HERCULES INC., RUN 8, INLET HV-12, OUTLET HV-13, UNIT A 1404-1806 3/12/75

INTERVAL OF CYCLE (MIN)	NOX IN DURING INTERVAL (GRAMS)	NOX ADSORBED DURING INTERVAL (GRAMS)	NOX REGEN. DURING INTERVAL (GRAMS)	NOX EMITTED DURING INTERVAL (GRAMS)	PERCENT OF NOX ADSORBED DURING INTERVAL	PERCENT NOX FOR REGEN. DURING INTERVAL	PERCENT REDUC. OF NOX DURING INTERVAL	AVERAGE PPM OF NOX EMIT. DURING INTERVAL
0.0- 2.0	1563.9	1522.4	8.13	33.32	97.35	0.52	97.87	73
2.0- 5.0	2303.6	2263.4	7.99	32.19	98.26	0.35	98.60	48
5.0- 11.0	4456.4	4372.3	16.99	67.14	98.11	0.38	98.49	51
11.0- 16.0	3547.1	3455.4	18.51	73.12	97.42	0.52	97.94	66
16.0- 18.0	1366.1	1321.6	8.97	35.45	96.75	0.66	97.40	80
18.0- 26.0	5307.0	5149.6	31.85	125.54	97.03	0.60	97.63	71
26.0- 31.0	3198.9	3124.8	15.00	59.07	97.68	0.47	98.15	53
31.0- 41.0	6403.0	6268.1	26.64	105.25	97.94	0.42	98.36	48
41.0- 46.0	3276.3	3213.2	12.76	50.41	98.07	0.39	98.46	46
46.0- 56.0	6566.6	6441.6	25.24	99.71	98.10	0.38	98.48	45
56.0- 72.0	10284.4	10071.2	43.07	170.17	97.93	0.42	98.35	48
72.0- 76.0	2526.7	2470.0	11.44	45.20	97.76	0.45	98.21	51
76.0- 86.0	6403.0	6251.4	30.00	118.54	97.68	0.47	98.15	54
86.0-101.0	9916.4	9672.1	49.21	195.06	97.54	0.50	98.03	59
101.0-116.0	10265.2	9992.5	55.10	217.60	97.34	0.54	97.88	65
116.0-131.0	10443.5	10151.3	59.31	232.86	97.20	0.57	97.77	70
131.0-136.0	3439.7	3340.9	20.05	78.72	97.13	0.58	97.71	72
136.0-146.0	6403.7	6206.7	41.22	161.85	96.83	0.64	97.47	74
146.0-154.0	4685.7	4518.9	33.87	133.00	96.44	0.72	97.16	76
154.0-161.0	3974.3	3825.4	30.23	118.69	96.25	0.76	97.01	77
161.0-176.0	8495.7	8160.0	68.14	267.54	96.05	0.80	96.85	81
176.0-192.0	9039.9	8653.1	78.51	308.28	95.72	0.87	96.59	87
192.0-196.0	2265.5	2164.9	20.41	80.15	95.56	0.90	96.46	91
196.0-206.0	5871.0	5612.7	52.44	205.89	95.60	0.89	96.49	93
206.0-216.0	6516.6	6236.3	56.64	221.67	95.73	0.87	96.60	101
216.0-221.0	3516.8	3366.0	30.84	119.96	95.71	0.88	96.59	110
221.0-227.0	4226.1	4034.1	39.37	152.65	95.46	0.93	96.39	117
227.0-236.0	5797.5	5500.9	60.82	235.83	94.88	1.05	95.93	120
236.0-242.0	3659.9	3461.3	40.71	157.87	94.57	1.11	95.69	121

TABLE A-24. CUMULATIVE NO_X MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF NO_X EMITTED DURING TEST -- 8

HERCULES INC., RUN 8, INLET HV-12, OUTLET HV-13, UNIT A 1404-1806 3/12/75

TIME INTO CYCLE (MIN)	TOTAL NOX IN (GRAMS)	TOTAL NOX ADS. (GRAMS)	NOX USED FOR REGEN. (GRAMS)	TOTAL NOX EMIT. (GRAMS)	% NOX REDUC. DUE TO ADS.	% NOX REDUC. DUE TO REGEN.	AVG. % REDUC. OF NOX	AVG. PPM OF NOX EMIT.
0								
2.0	1563.9	1522.4	8.1	33.3	97.35	0.52	97.87	72
5.0	3867.5	3785.9	16.1	65.5	97.89	0.42	98.31	58
11.0	8323.9	8158.1	33.1	132.7	98.01	0.40	98.41	54
16.0	11870.9	11613.6	51.6	205.8	97.83	0.43	98.27	58
18.0	13237.0	12935.2	60.6	241.2	97.72	0.46	98.18	60
26.0	18544.0	18084.8	92.4	366.8	97.52	0.50	98.02	63
31.0	21742.8	21209.6	107.5	425.8	97.55	0.49	98.04	62
41.0	28142.8	27477.7	134.1	531.1	97.64	0.48	98.11	58
46.0	31419.2	30690.8	146.8	581.5	97.68	0.47	98.15	57
56.0	37985.7	37132.5	172.1	681.2	97.75	0.45	98.21	55
72.0	48270.1	47203.6	215.2	851.4	97.79	0.45	98.24	53
76.0	50796.8	49673.6	226.6	896.6	97.79	0.45	98.23	53
86.0	57196.8	55925.1	256.6	1015.1	97.78	0.45	98.23	53
101.0	67113.1	65597.2	305.8	1210.2	97.74	0.46	98.20	54
116.0	77378.4	75589.7	360.9	1427.8	97.69	0.47	98.15	55
131.0	87321.3	85741.0	420.2	1660.6	97.63	0.48	98.11	57
136.0	91261.5	89081.9	440.3	1739.4	97.61	0.48	98.09	58
146.0	97671.3	95298.6	481.5	1901.2	97.56	0.49	98.05	59
154.0	102357.0	99807.4	515.4	2034.2	97.51	0.50	98.01	60
161.0	106531.3	103632.8	545.6	2152.9	97.46	0.51	97.98	60
176.0	114827.0	111792.8	613.7	2420.4	97.36	0.53	97.89	62
192.0	123366.9	120446.0	692.2	2728.7	97.24	0.56	97.80	64
196.0	125132.4	122610.9	712.7	2808.9	97.21	0.56	97.77	65
206.0	132003.4	125223.[illegible]	765.1	3014.8	97.14	0.58	97.72	66
216.0	138520.0	134461.9	821.7	3236.4	97.07	0.59	97.66	68
221.0	142336.8	137827.8	852.6	3356.4	97.04	0.60	97.64	69
227.0	146262.9	141861.9	891.9	3509.1	96.99	0.61	97.60	70
236.0	152060.4	147362.8	952.8	3744.9	96.91	0.63	97.54	72
242.0	155720.3	150824.1	993.5	3902.8	96.86	0.64	97.49	73

TABLE A-25. SUMMARY OF CALCULATED NO_x MASS FLOW RATES AND CONTROL EFFICIENCIES FOR INSTANTANEOUS FLOW AND CONCENTRATION DATA FOR TEST -- 9

HERCULES INC., RUN 9, INLET HV-23, OUTLET HV-13 UNIT B 1017-1503 3/13/75

TIME INTO CYCLE (MIN)	INLET FLOW (SCFM)	REGEN. FLOW (SCFM)	INLET CONC. (PPM)	OUTLET CONC. (PPM)	MASS FLOW RATE IN (G/MIN)	MASS FLOW RATE ADS. (G/MIN)	MASS FLOW RATE REGEN. (G/MIN)	MASS FLOW RATE EMIT. (G/MIN)	% REDUC. OF NOX DUE TO ADS.	% REDUC. OF NOX DUE TO REGEN.	% REDUC. OF NOX
0.0	4300	1030	1880	40	444.5	435.0	2.27	7.19	97.87	0.51	98.38
13.0	4300	1030	1900	45	449.2	438.6	2.55	8.09	97.63	0.57	98.20
18.0	4300	1030	1860	50	439.7	427.9	2.83	8.99	97.31	0.64	97.96
22.0	4300	1030	1860	58	439.7	426.0	3.28	10.43	96.88	0.75	97.63
25.0	3050	1030	1810	55	303.5	294.3	3.11	6.11	96.96	1.03	97.99
28.0	3040	1030	1800	52	300.9	292.2	2.94	5.75	97.11	0.98	98.09
32.0	3040	1030	1770	45	295.8	288.3	2.55	4.97	97.46	0.86	98.32
37.0	3040	1030	1740	39	290.8	284.3	2.21	4.31	97.76	0.76	98.52
43.0	3040	1030	1750	38	292.5	286.2	2.15	4.20	97.83	0.74	98.56
53.0	3040	1030	2050	32	342.6	337.3	1.81	3.54	98.44	0.53	98.97
73.0	5000	1035	1850	31	508.6	500.1	1.76	6.76	98.32	0.35	98.67
78.0	5175	1035	1660	30	472.3	463.8	1.71	6.83	98.19	0.36	98.55
81.0	3650	1030	1660	30	333.1	327.1	1.70	4.32	98.19	0.51	98.70
83.0	3650	1030	1500	30	301.0	295.0	1.70	4.32	98.00	0.56	98.56
85.0	3625	1030	1480	30	295.0	289.0	1.70	4.28	97.97	0.58	98.55
85.0	3625	1030	1360	30	271.1	265.1	1.70	4.28	97.79	0.63	98.42
87.0	3525	1030	1450	30	281.0	275.2	1.70	4.12	97.93	0.60	98.54
88.0	6100	1015	1447	30	485.3	475.2	1.67	8.39	97.93	0.34	98.27
93.0	6250	1020	1840	30	632.3	622.0	1.68	8.63	98.37	0.27	98.64
103.0	5800	1040	2940	44	937.5	923.5	2.52	11.52	98.50	0.27	98.77
108.0	5825	1035	2890	45	925.6	911.2	2.56	11.85	98.44	0.28	98.72
120.0	5825	1035	3020	54	967.2	949.9	3.07	14.22	98.21	0.32	98.53
125.0	5800	1035	3120	56	994.9	977.1	3.19	14.67	98.21	0.32	98.53
130.0	5800	1030	3360	64	1071.5	1051.1	3.62	16.78	98.10	0.34	98.43
140.0	5775	1030	3440	76	1092.3	1068.1	4.30	19.83	97.79	0.39	98.18
150.0	5775	1035	3640	81	1155.8	1130.0	4.61	21.11	97.77	0.40	98.17
160.0	5750	1030	3810	91	1204.5	1175.7	5.15	23.62	97.61	0.43	98.04
170.0	5825	1030	3860	108	1236.2	1201.0	6.12	28.47	97.20	0.49	97.70
180.0	5800	1030	3990	115	1272.4	1235.7	6.51	30.16	97.12	0.51	97.63
182.0	5800	1030	3900	118	1243.7	1206.1	6.68	30.95	95.97	0.54	97.51
183.0	5800	1030	4290	119	1368.0	1330.1	6.74	31.21	97.23	0.49	97.72
184.0	5800	1030	4370	119	1393.6	1355.6	6.74	31.21	97.28	0.48	97.76
190.0	5800	1030	4120	126	1313.8	1273.7	7.14	33.04	95.94	0.54	97.48
195.0	5825	1030	4170	134	1335.5	1292.6	7.59	35.33	96.79	0.57	97.35
205.0	5800	1030	3980	146	1269.2	1222.6	8.27	38.29	95.33	0.65	96.98
210.0	5800	1030	3790	150	1208.6	1160.8	8.49	39.34	95.04	0.70	96.75
211.0	6350	1015	3790	150	1323.2	1270.8	8.37	44.00	95.04	0.63	96.67
213.0	6350	1015	3810	150	1330.2	1277.8	8.37	44.00	96.06	0.63	96.69
214.0	6375	1015	3750	150	1314.4	1261.8	8.37	44.21	96.00	0.64	96.64
215.0	4325	1065	3360	152	799.0	762.8	8.90	27.24	95.48	1.11	96.59
216.0	4325	1065	3240	151	770.5	734.5	8.84	27.07	95.34	1.15	96.49
217.0	4325	1065	3230	151	768.1	732.2	8.84	27.07	95.33	1.15	96.48
218.0	4325	1065	3260	186	775.2	731.0	10.89	33.34	94.29	1.40	95.70
219.0	4325	1065	2600	74	618.3	600.7	4.33	13.26	97.15	0.70	97.85
220.0	4325	1065	2600	149	618.3	582.8	8.72	26.71	94.27	1.41	95.68
225.0	4325	1065	3080	150	732.4	696.7	8.78	26.89	95.13	1.20	96.33
230.0	4325	1065	3290	148	782.3	747.2	8.67	26.53	95.50	1.11	96.61

TABLE A-25. SUMMARY OF CALCULATED NO_X MASS FLOW RATES AND CONTROL EFFICIENCIES FOR INSTANTANEOUS FLOW AND CONCENTRATION DATA FOR TEST -- 9 (CONTINUED)

HERCULES INC., RUN 9, INLET HV-23, OUTLET HV-13 UNIT B 1017-1503 3/13/75

TIME INTO CYCLE (MIN)	INLET FLOW (SCFM)	REGEN. FLOW (SCFM)	INLET CONC. (PPM)	OUTLET CONC. (PPM)	MASS FLOW RATE IN (G/MIN)	MASS FLOW RATE ADS. (G/MIN)	MASS FLOW RATE REGEN. (G/MIN)	MASS FLOW RATE EMIT. (G/MIN)	% REDUC. OF NOX DUE TO ADS.	% REDUC. OF NOX DUE TO REGEN.	% REDUC. OF NOX
235.0	4325	1065	3640	149	865.6	830.1	8.72	26.71	95.91	1.01	96.91
243.0	4325	1065	3630	151	863.2	827.3	8.84	27.07	95.84	1.02	96.86
244.0	4325	1065	3090	158	734.6	697.2	9.25	28.32	94.89	1.26	96.15
249.0	4325	1065	3080	160	732.4	694.4	9.37	28.68	94.81	1.28	96.08
253.0	4325	1065	3470	166	825.1	785.7	9.72	29.75	95.22	1.18	96.39
255.0	6125	1190	4050	174	1363.9	1305.3	11.38	47.21	95.70	0.83	96.54
263.0	6125	1200	4260	189	1434.6	1371.0	12.47	51.18	95.56	0.87	96.43
264.0	6125	1140	4220	194	1421.1	1355.8	12.16	53.17	95.40	0.86	96.26
266.0	6075	1065	2850	195	951.9	886.8	11.42	53.71	93.16	1.20	94.36
267.0	6075	1035	2850	200	951.9	885.1	11.38	55.42	92.98	1.20	94.18
272.0	6050	1025	2560	201	851.6	784.7	11.33	55.53	92.15	1.33	93.48
283.0	6225	1025	2160	192	739.3	673.6	10.82	54.89	91.11	1.46	92.57
283.0	6225	1025	2060	188	705.1	640.7	10.59	53.75	90.87	1.50	92.38

TABLE A-26. SUMMARY OF NO_X MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF NO_X EMITTED FOR INTERVALS DURING TEST -- 9

HERCULES INC., RUN 9, INLET HV-23, OUTLET HV-13 UNIT 8 1017-1503 3/13/75

INTERVAL OF CYCLE (MIN)	NOX IN DURING INTERVAL (GRAMS)	NOX ADSORBED DURING INTERVAL (GRAMS)	NOX REGEN. DURING INTERVAL (GRAMS)	NOX EMITTED DURING INTERVAL (GRAMS)	PERCENT OF NOX ADSORBED DURING INTERVAL	PERCENT NOX FOR REGEN. DURING INTERVAL	PERCENT REDUC. OF NOX DURING INTERVAL	AVERAGE PPM OF NOX EMIT. DURING INTERVAL
0.0- 13.0	5808.8	5678.2	31.29	99.33	97.75	0.54	98.29	43
13.0- 18.0	2222.4	2166.2	13.45	42.70	97.47	0.61	98.08	47
18.0- 22.0	1759.0	1707.9	12.23	38.83	97.10	0.70	97.79	54
22.0- 26.0	1486.5	1440.7	12.80	33.07	96.91	0.86	97.78	57
26.0- 28.0	604.4	586.5	6.06	11.86	97.04	1.00	98.04	54
28.0- 32.0	1193.4	1161.0	10.99	21.44	97.28	0.92	98.20	48
32.0- 37.0	1466.7	1431.6	11.89	23.21	97.61	0.81	98.42	42
37.0- 43.0	1754.0	1711.4	13.08	25.53	97.79	0.75	98.54	39
43.0- 58.0	4763.6	4675.8	29.73	58.02	98.16	0.62	98.78	35
58.0- 73.0	6384.2	6280.1	26.82	77.21	98.37	0.42	98.79	31
73.0- 78.0	2452.2	2409.6	8.68	33.97	98.26	0.35	98.61	30
78.0- 81.0	1208.2	1186.3	5.11	16.73	98.19	0.42	98.62	30
81.0- 83.0	634.2	622.1	3.40	8.64	98.10	0.54	98.64	30
83.0- 85.0	595.0	584.0	3.40	8.60	97.99	0.57	98.56	30
85.0- 86.0	283.0	277.0	1.70	4.28	97.89	0.60	98.49	30
86.0- 87.0	276.0	270.1	1.70	4.20	97.86	0.62	98.48	30
87.0- 88.0	383.2	375.2	1.69	6.25	97.93	0.44	98.37	30
88.0- 93.0	2794.0	2743.1	8.39	42.54	98.18	0.30	98.48	30
93.0-103.0	7849.2	7727.5	20.99	100.71	98.45	0.27	98.72	37
103.0-108.0	4657.8	4586.7	12.69	58.42	98.47	0.27	98.75	45
108.0-120.0	11356.7	11166.4	33.80	156.44	98.32	0.30	98.62	50
120.0-125.0	4905.4	4817.5	15.65	72.23	98.21	0.32	98.53	55
125.0-130.0	5165.1	5070.4	17.03	78.64	98.15	0.33	98.48	60
130.0-145.0	16228.1	15894.0	59.46	274.59	97.94	0.37	98.31	70
145.0-150.0	5621.1	5495.4	22.28	102.34	97.78	0.40	98.18	78
150.0-160.0	11801.4	11528.9	48.81	223.63	97.69	0.41	98.11	86
160.0-175.0	18305.5	17830.3	64.52	390.66	97.40	0.46	97.87	100
175.0-180.0	6271.5	6093.4	31.57	146.58	97.16	0.50	97.66	111
180.0-182.0	2516.1	2441.8	13.20	61.11	97.05	0.52	97.57	116
182.0-183.0	1305.9	1268.1	6.71	31.08	97.11	0.51	97.62	118
183.0-184.0	1380.8	1342.9	6.74	31.21	97.25	0.49	97.74	119
184.0-190.0	8122.2	7887.8	41.62	192.76	97.11	0.51	97.63	123
190.0-195.0	6623.4	6415.6	36.81	170.93	96.86	0.56	97.42	130
195.0-205.0	13023.5	12576.2	79.28	36[illegible].79	96.56	0.61	97.17	140
205.0-210.0	6194.5	5958.5	41.91	1[illegible].67	96.19	0.68	96.87	148
210.0-211.0	1265.9	1215.8	8.43	41.67	96.04	0.67	96.71	150
211.0-213.0	2653.4	2548.7	16.74	88.00	96.05	0.63	96.68	150
213.0-214.0	1322.3	1269.8	8.37	44.10	96.03	0.63	96.66	150
214.0-215.0	1056.7	1012.3	8.64	35.72	95.80	0.82	96.62	151
215.0-216.0	784.7	748.7	8.87	27.15	95.41	1.13	96.54	151
216.0-217.0	769.3	733.4	8.84	27.07	95.33	1.15	96.48	151
217.0-218.0	771.6	731.6	9.87	30.20	94.81	1.28	96.09	168
218.0-219.0	696.7	665.8	7.61	23.30	95.56	1.09	96.66	130
219.0-220.0	618.3	591.8	6.53	19.99	95.71	1.06	96.77	111
220.0-225.0	3376.7	3198.9	43.77	133.98	94.74	1.30	96.03	149
225.0-230.0	3786.9	3609.7	43.62	133.53	95.32	1.15	96.47	149
230.0-235.0	4119.8	3943.2	43.48	133.09	95.71	1.06	96.77	148

TABLE A-26. SUMMARY OF NO_X MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF NO_X EMITTED FOR INTERVALS DURING TEST -- 9 (CONTINUED)

HERCULES INC., RUN 9, INLET HV-23, OUTLET HV-13 UNIT 3 1017-1503 3/13/75

INTERVAL OF CYCLE (MIN)	NOX IN DURING INTERVAL (GRAMS)	NOX ADSORBED DURING INTERVAL (GRAMS)	NOX REGEN. DURING INTERVAL (GRAMS)	NOX EMITTED DURING INTERVAL (GRAMS)	PERCENT OF NOX ADSORBED DURING INTERVAL	PERCENT NOX FOR REGEN. DURING INTERVAL	PERCENT REDUC. OF NOX DURING INTERVAL	AVERAGE PPM OF NOX EMIT. DURING INTERVAL
235.0-240.0	4321.9	4143.6	43.92	134.43	95.87	1.02	96.89	150
240.0-244.0	3196.0	3049.0	36.19	110.77	95.40	1.13	96.53	154
244.0-246.0	1467.2	1391.6	18.62	57.00	94.85	1.27	96.12	159
246.0-250.0	3115.1	2960.1	38.18	116.86	95.02	1.23	96.25	163
250.0-255.0	5472.6	5227.4	52.76	192.41	95.52	0.96	96.48	171
255.0-260.0	6996.2	6690.6	59.64	245.98	95.63	0.85	96.48	181
260.0-264.0	5711.5	5453.5	49.26	208.70	95.48	0.86	96.35	192
264.0-266.0	2373.1	2242.6	23.58	106.89	94.50	0.99	95.50	195
266.0-267.0	951.9	886.0	11.40	54.57	93.07	1.20	94.27	198
267.0-272.0	4508.7	4174.6	56.77	277.38	92.59	1.26	93.85	200
272.0-280.0	6363.3	5833.0	88.59	441.70	91.67	1.39	93.06	196
280.0-283.0	2166.5	1971.4	32.12	162.97	91.00	1.48	92.48	190

TABLE A-27. CUMULATIVE NO_x MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF NO_x EMITTED DURING TEST -- 9

HERCULES INC., RUN 9, INLET HV-23, OUTLET HV-13 UNIT B 1017-1503 3/13/75

TIME INTO CYCLE (MIN)	TOTAL NOX IN (GRAMS)	TOTAL NOX ADS. (GRAMS)	NOX USED FOR REGEN. (GRAMS)	TOTAL NOX EMIT. (GRAMS)	% NOX REDUC. DUE TO ADS.	% NOX REDUC. DUE TO REGEN.	AVG. % REDUC. OF NOX	AVG. PPM OF NOX EMIT.
0								
13.0	5808.8	5678.2	31.3	99.3	97.75	0.54	98.29	42
18.0	8031.2	7844.4	44.7	142.0	97.67	0.56	98.23	44
22.0	9790.2	9552.3	57.0	180.9	97.57	0.58	98.15	46
26.0	11276.7	10993.0	69.8	213.9	97.48	0.62	98.10	47
28.0	11881.1	11579.5	75.8	225.8	97.46	0.64	98.10	47
32.0	13074.5	12740.4	86.8	247.2	97.45	0.66	98.11	48
37.0	14541.2	14172.0	98.7	270.4	97.46	0.68	98.14	47
43.0	16291.2	15883.4	111.8	296.0	97.50	0.69	98.18	46
58.0	21054.8	20559.3	141.5	354.0	97.65	0.67	98.32	44
73.0	27438.9	26839.4	168.3	431.2	97.81	0.61	98.43	41
78.0	29691.2	29249.0	177.0	465.2	97.85	0.59	98.44	40
81.0	31099.4	30435.3	182.1	481.9	97.86	0.59	98.45	39
83.0	31733.5	31057.4	185.5	490.5	97.87	0.58	98.45	39
85.0	32329.5	31641.4	188.9	499.1	97.87	0.58	98.46	39
86.0	32612.5	31918.5	190.6	503.4	97.87	0.58	98.46	39
87.0	32888.6	32188.6	192.3	507.6	97.87	0.58	98.46	39
88.0	33271.7	32563.9	194.0	513.9	97.87	0.58	98.46	39
93.0	36065.7	35306.9	202.4	556.4	97.90	0.56	98.46	38
103.0	43914.9	43034.4	223.4	657.1	97.99	0.51	98.50	38
108.0	48572.7	47621.0	236.1	715.5	98.04	0.49	98.53	38
120.0	59929.3	58787.5	269.9	872.0	98.09	0.45	98.55	40
125.0	64834.7	63605.0	285.5	944.2	98.10	0.44	98.54	41
133.0	70000.8	68675.4	302.6	1022.8	98.11	0.43	98.54	42
145.0	86228.8	84569.4	362.0	1297.4	98.08	0.42	98.50	46
153.0	91848.9	90064.8	384.3	1399.8	98.06	0.42	98.48	47
163.0	103650.2	101593.7	433.1	1623.4	98.02	0.42	98.43	50
175.0	121755.8	119424.1	517.6	2014.1	97.92	0.42	98.35	56
180.0	128227.3	125517.4	549.2	2160.6	97.89	0.43	98.31	57
182.0	130743.3	127959.2	562.4	2221.7	97.87	0.43	98.30	58
183.0	132049.2	129227.3	569.1	2252.8	97.86	0.43	98.29	59
184.0	133430.0	130570.1	575.9	2284.0	97.86	0.43	98.29	59
190.0	141552.2	138457.9	617.5	2476.8	97.81	0.44	98.25	62
195.0	148175.6	144873.6	654.3	2647.7	97.77	0.44	98.21	64
205.0	161199.1	157449.7	733.6	3015.8	97.67	0.46	98.13	68
210.0	167393.5	163408.2	775.5	3209.9	97.62	0.46	98.08	71
211.0	168659.5	164624.0	783.9	3251.6	97.61	0.46	98.07	71
213.0	171312.9	167172.7	800.7	3339.6	97.58	0.47	98.05	72
214.0	172635.2	168442.5	809.0	3383.7	97.57	0.47	98.04	73
215.0	173691.9	169454.9	817.7	3419.4	97.56	0.47	98.03	73
216.0	174476.6	170203.6	826.5	3446.5	97.55	0.47	98.02	73
217.0	175245.9	170936.9	835.4	3473.6	97.54	0.48	98.02	74
218.0	176017.5	171668.5	845.2	3503.8	97.53	0.48	98.01	74
219.0	176714.3	172334.3	852.9	3527.1	97.52	0.48	98.00	74
220.0	177332.5	172926.1	859.4	3547.1	97.52	0.48	98.00	74
225.0	180709.2	176125.0	903.2	3681.1	97.46	0.50	97.96	76
230.0	184496.1	179734.7	946.8	3814.6	97.42	0.51	97.93	77

TABLE A-27. CUMULATIVE NO_X MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF NO_X EMITTED DURING TEST -- 9 (CONTINUED)

HERCULES INC., RUN 9, INLET HV-23, OUTLET HV-13 UNIT 9 1017-1503 3/13/75

TIME INTO CYCLE (MIN)	TOTAL NOX IN (GRAMS)	TOTAL NOX ADS. (GRAMS)	NOX USED FOR REGEN. (GRAMS)	TOTAL NOX EMIT. (GRAMS)	% NOX REDUC. DUE TO ADS.	% NOX REDUC. DUE TO REGEN.	AVG. % REDUC. OF NOX	AVG. PPM OF NOX EMIT.
233.0	188615.9	183678.0	990.3	3947.7	97.38	0.53	97.91	78
243.0	192937.3	187821.5	1034.2	4082.1	97.35	0.54	97.88	79
244.0	196133.3	190870.5	1070.4	4192.9	97.32	0.55	97.86	81
245.0	197631.0	192262.1	1089.0	4249.9	97.30	0.55	97.85	81
253.0	200716.1	195222.2	1127.2	4366.8	97.26	0.56	97.82	82
255.0	206188.7	200449.6	1179.9	4559.2	97.22	0.57	97.79	84
263.0	213184.3	207140.2	1239.6	4805.1	97.16	0.58	97.75	86
264.0	218396.4	212593.7	1288.8	5013.8	97.12	0.59	97.71	88
265.0	221269.4	214836.3	1312.4	5120.7	97.09	0.59	97.69	89
267.0	222221.4	215722.3	1323.8	5175.3	97.08	0.60	97.67	90
272.0	226730.1	219896.8	1380.6	5452.7	96.99	0.61	97.60	93
283.0	233393.4	225729.9	1469.2	5894.4	96.84	0.63	97.47	96
283.0	235259.9	227701.3	1501.3	6057.4	96.79	0.64	97.43	98

TABLE A-28. SUMMARY OF CALCULATED NO_x MASS FLOW RATES AND CONTROL EFFICIENCIES FOR INSTANTANEOUS FLOW AND CONCENTRATION DATA FOR TEST -- 10

HERCULES INC., RUN 10, INLET HV-23, OUTLET HV-13 UNIT A 1503-1905 3/13/75

TIME INTO CYCLE (MIN)	INLET FLOW (SCFM)	REGEN. FLOW (SCFM)	INLET CONC. (PPM)	OUTLET CONC. (PPM)	MASS FLOW RATE IN (G/MIN)	MASS FLOW RATE ADS. (G/MIN)	MASS FLOW RATE REGEN. (G/MIN)	MASS FLOW RATE EMIT. (G/MIN)	% REDUC. OF NOX DUE TO ADS.	% REDUC. OF NOX DUE TO REGEN.	% REDUC. OF NOX
0.0	6225	1025	2060	188	705.1	640.7	10.59	53.75	90.87	1.50	92.38
1.0	5925	1025	2060	116	671.1	633.3	6.54	31.25	94.37	0.97	95.34
6.0	5950	1025	2510	89	821.1	792.0	5.02	24.10	96.45	0.61	97.07
7.0	5950	1025	2630	89	860.4	831.3	5.02	24.10	96.62	0.58	97.20
12.0	5925	1025	3100	119	1009.9	971.1	6.71	32.06	95.16	0.66	96.83
14.0	5925	1025	2970	145	967.5	920.3	8.17	39.06	95.12	0.84	95.96
18.0	5950	1025	3080	124	1007.6	967.0	6.99	33.58	95.97	0.69	96.67
20.0	5950	1025	2910	95	952.0	920.9	5.35	25.72	96.74	0.56	97.30
21.0	5950	1025	2880	85	942.2	914.4	4.79	23.02	97.05	0.51	97.56
22.0	5950	1025	2880	79	942.2	916.3	4.45	21.39	97.26	0.47	97.73
25.0	5975	1025	3050	65	1002.0	980.6	3.66	17.69	97.87	0.37	98.23
27.0	5975	1025	2980	66	979.0	957.3	3.72	17.96	97.79	0.38	98.17
32.0	6000	1025	2850	56	940.2	921.7	3.16	15.32	98.04	0.34	98.37
33.0	6000	1025	2990	56	986.4	967.9	3.16	15.32	98.13	0.32	98.45
34.0	6000	1025	2720	55	897.3	879.2	3.10	15.04	97.98	0.35	98.32
42.0	6075	1025	2860	54	955.3	937.2	3.04	14.99	98.11	0.32	98.43
48.0	6075	1025	3000	51	1002.0	985.0	2.87	14.16	98.30	0.29	98.59
50.0	6075	1025	2850	51	951.9	934.9	2.87	14.16	98.21	0.30	98.51
51.0	6075	1025	2980	51	995.4	978.3	2.87	14.16	98.29	0.29	98.58
53.0	6075	1025	3030	50	1012.1	995.4	2.82	13.88	98.35	0.28	98.63
57.0	6075	1025	2910	49	972.0	955.6	2.76	13.61	98.32	0.28	98.60
63.0	6075	1025	2960	51	988.7	971.6	2.87	14.16	98.28	0.29	98.57
66.0	6075	1025	3100	55	1035.4	1017.1	3.10	15.27	98.23	0.30	98.53
69.0	6075	1025	3020	59	1008.7	989.0	3.33	16.38	98.05	0.33	98.38
72.0	6100	1025	3110	62	1043.1	1022.3	3.49	17.30	98.01	0.33	98.34
78.0	6100	1025	2860	70	959.2	935.7	3.94	19.53	97.55	0.41	97.96
82.0	6100	1025	2950	76	989.4	963.9	4.28	21.21	97.42	0.43	97.86
84.0	6100	1025	2900	78	972.6	946.5	4.40	21.76	97.31	0.45	97.76
85.0	6100	1025	3040	79	1019.6	993.1	4.45	22.04	97.40	0.44	97.84
87.0	6075	1025	2990	81	998.7	971.6	4.56	22.49	97.29	0.46	97.75
92.0	6075	1025	2920	85	975.3	946.9	4.79	23.60	97.09	0.49	97.58
93.0	6075	1025	2940	89	982.0	952.3	5.02	24.71	96.97	0.51	97.48
95.0	6075	1025	2710	94	905.2	873.8	5.30	26.10	95.53	0.59	97.12
98.0	6075	1025	2710	96	905.2	873.1	5.41	26.66	96.46	0.60	97.06
102.0	6075	1025	2950	101	985.3	951.6	5.69	28.04	95.58	0.58	97.15
117.0	6100	1025	3160	119	1059.8	1019.9	6.71	33.20	95.23	0.63	96.87
132.0	6100	1075	3200	132	1073.2	1029.0	7.80	36.47	95.88	0.73	96.60
137.0	6125	1025	3120	136	1050.7	1004.9	7.66	38.14	95.64	0.73	96.37
147.0	6150	1025	3050	142	1031.3	983.3	8.00	40.01	95.34	0.78	96.12
152.0	6150	1025	3060	146	1034.7	985.3	8.23	41.14	95.23	0.80	96.02
162.0	6100	1025	3210	159	1076.6	1023.3	8.96	44.37	95.05	0.83	95.88
167.0	6075	1025	3160	165	1055.5	1000.4	9.30	45.81	94.78	0.88	95.66
173.0	6075	1025	3120	175	1042.1	983.7	9.86	48.59	94.39	0.95	95.34
177.0	6075	1025	3200	179	1068.8	1009.1	10.09	49.70	94.41	0.94	95.35
187.0	6075	1025	3380	196	1129.0	1063.5	11.05	54.42	94.20	0.98	95.18
188.0	6075	1025	3480	198	1162.4	1096.2	11.16	54.98	94.31	0.96	95.27
192.0	6050	1025	3380	208	1124.3	1055.1	11.72	57.47	93.85	1.04	94.89

TABLE A-28. SUMMARY OF CALCULATED NO_x MASS FLOW RATES AND CONTROL EFFICIENCIES FOR INSTANTANEOUS FLOW AND CONCENTRATION DATA FOR TEST -- 10 (CONTINUED)

HERCULES INC., RUN 10, INLET HV-23 OUTLET HV-13 UNIT A 1503-1905 3/13/75

TIME INTO CYCLE (MIN)	INLET FLOW (SCFM)	REGEN. FLOW (SCFM)	INLET CONC. (PPM)	OUTLET CONC. (PPM)	MASS FLOW RATE IN (G/MIN)	MASS FLOW RATE ADS. (G/MIN)	MASS FLOW RATE REGEN. (G/MIN)	MASS FLOW RATE EMIT. (G/MIN)	% REDUC. OF NOX DUE TO ADS.	% REDUC. OF NOX DUE TO REGEN.	% REDUC. OF NOX
207.0	6075	1025	3500	230	1169.0	1092.2	12.96	63.86	93.43	1.11	94.54
217.0	6050	1025	3610	245	1200.8	1119.3	13.81	67.69	93.21	1.15	94.36
223.0	6050	1025	3580	254	1190.8	1106.4	14.31	70.18	92.91	1.20	94.11
229.0	6050	1025	3560	258	1184.2	1098.4	14.54	71.28	92.75	1.23	93.96
231.0	6050	1025	3520	264	1170.9	1083.1	14.88	72.94	92.50	1.27	93.77
237.0	6050	1035	3600	264	1197.5	1109.7	15.02	72.79	92.67	1.25	93.92
242.0	6050	1025	3520	268	1170.9	1081.7	15.10	74.04	92.39	1.29	93.68

TABLE A-29. SUMMARY OF NO_x MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF NO_x EMITTED FOR INTERVALS DURING TEST -- 10

HERCULES INC., RUN 10, INLET HV-23, OUTLET HV-13 UNIT A 1503-1905 3/13/75

INTERVAL OF CYCLE (MIN)	NOX IN DURING INTERVAL (GRAMS)	NOX ADSORBED DURING INTERVAL (GRAMS)	NOX REGEN. DURING INTERVAL (GRAMS)	NOX EMITTED DURING INTERVAL (GRAMS)	PERCENT OF NOX ADSORBED DURING INTERVAL	PERCENT NOX FOR REGEN. DURING INTERVAL	PERCENT REDUC. OF NOX DURING INTERVAL	AVERAGE PPM OF NOX EMIT. DURING INTERVAL
0.0- 1.0	688.1	637.0	8.57	42.50	92.58	1.24	93.82	153
1.0- 6.0	3730.5	3563.2	28.88	138.38	95.52	0.77	96.29	102
6.0- 7.0	847.7	811.6	5.02	24.10	96.54	0.60	97.13	89
7.0- 12.0	4675.6	4505.9	29.31	140.40	96.37	0.63	97.00	104
12.0- 14.0	1977.4	1891.4	14.88	71.12	95.65	0.75	96.40	132
14.0- 18.0	3953.2	3774.6	30.32	145.28	95.55	0.77	96.32	134
19.0- 20.0	1959.6	1887.9	12.34	59.30	96.34	0.63	96.97	109
20.0- 21.0	947.1	917.6	5.07	24.37	96.89	0.54	97.43	90
21.0- 22.0	947.2	915.3	4.62	22.20	97.15	0.49	97.64	82
22.0- 25.0	2916.2	2845.4	12.17	58.62	97.57	0.42	97.99	72
25.0- 27.0	1983.3	1937.9	7.38	35.65	97.83	0.37	98.20	65
27.0- 32.0	4797.9	4697.5	17.19	83.20	97.91	0.36	98.27	61
32.0- 33.0	963.3	944.8	3.16	15.32	98.08	0.33	98.41	56
33.0- 34.0	941.8	923.5	3.13	15.18	98.06	0.33	98.39	55
34.0- 42.0	7410.3	7265.6	24.57	120.15	98.05	0.33	98.38	54
42.0- 48.0	5871.9	5766.7	17.75	87.46	98.21	0.30	98.51	53
48.0- 50.0	1954.3	1919.9	5.75	28.32	98.26	0.29	98.55	51
50.0- 51.0	973.5	956.6	2.87	14.16	98.25	0.30	98.55	51
51.0- 53.0	2007.4	1973.7	5.69	28.04	98.32	0.28	98.60	50
53.0- 57.0	3963.1	3901.9	11.16	54.98	98.33	0.28	98.61	50
57.0- 63.0	5882.0	5781.8	16.91	83.30	98.30	0.29	98.58	50
63.0- 66.0	3036.2	2983.1	8.96	44.15	98.25	0.30	98.55	53
66.0- 68.0	2044.2	2006.1	6.42	31.65	98.14	0.31	98.45	57
68.0- 72.0	4103.5	4022.5	13.64	67.36	98.03	0.33	98.36	61
72.0- 78.0	6096.8	5974.0	22.32	110.50	97.79	0.37	98.16	66
78.0- 82.0	3897.2	3799.3	16.46	81.48	97.49	0.42	97.91	73
82.0- 84.0	1962.3	1910.4	8.68	42.97	97.37	0.44	97.81	77
84.0- 85.0	996.1	969.8	4.42	21.90	97.36	0.44	97.80	78
85.0- 87.0	2019.3	1964.7	9.02	44.53	97.35	0.45	97.79	80
87.0- 92.0	4935.0	4796.4	23.39	115.23	97.19	0.47	97.67	83
92.0- 93.0	978.7	949.6	4.90	24.16	97.03	0.50	97.53	87
93.0- 96.0	2830.8	2739.1	15.47	76.22	96.76	0.55	97.31	91
96.0- 98.0	1813.3	1746.9	10.71	52.75	96.49	0.59	97.09	95
98.0-102.0	3781.0	3649.4	22.20	109.40	96.52	0.59	97.11	99
102.0-117.0	15338.7	14786.3	92.99	459.36	96.40	0.61	97.01	110
117.0-132.0	15998.0	15366.6	108.81	522.55	96.05	0.68	96.73	125
132.0-137.0	5339.8	5084.7	38.67	196.51	95.76	0.73	96.49	134
137.0-147.0	10410.1	9941.0	78.33	390.74	95.49	0.75	96.25	139
147.0-152.0	5165.0	4921.6	40.58	202.88	95.29	0.79	96.07	144
152.0-162.0	10556.4	10043.0	85.94	427.53	95.14	0.81	95.95	152
162.0-167.0	5330.2	5059.1	45.65	225.45	94.91	0.86	95.77	162
167.0-173.0	6292.8	5952.1	57.48	283.21	94.59	0.91	95.50	170
173.0-177.0	4221.9	3985.4	39.90	196.58	94.40	0.95	95.34	177
177.0-187.0	10989.0	10362.7	105.67	520.61	94.30	0.96	95.26	188
187.0-188.0	1145.7	1079.9	11.10	54.70	94.26	0.97	95.23	197
188.0-192.0	4573.4	4302.7	45.76	224.89	94.08	1.00	95.08	203
192.0-207.0	17203.2	16105.1	185.13	909.96	93.63	1.08	94.71	219

TABLE A-29. SUMMARY OF NO_X MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF NO_X EMITTED FOR INTERVALS DURING TEST -- 10 (CONTINUED)

HERCULES INC., RUN 10, INLET HV-23, OUTLET HV-13 UNIT A 1503-1905 3/13/75

INTERVAL OF CYCLE (MIN)	NOX IN DURING INTERVAL (GRAMS)	NOX ADSORBED DURING INTERVAL (GRAMS)	NOX REGEN. DURING INTERVAL (GRAMS)	NOX EMITTED DURING INTERVAL (GRAMS)	PERCENT OF NOX ADSORBED DURING INTERVAL	PERCENT NOX FOR REGEN. DURING INTERVAL	PERCENT REDUC. OF NOX DURING INTERVAL	AVERAGE PPM OF NOX EMIT. DURING INTERVAL
207.0-217.0	11849.3	11057.7	133.85	657.75	93.32	1.13	94.45	237
217.0-223.0	7175.0	6677.0	84.36	413.59	93.06	1.18	94.24	250
223.0-225.0	2375.0	2204.7	28.85	141.46	92.83	1.21	94.04	256
225.0-231.0	7065.2	6544.3	88.25	432.66	92.63	1.25	93.88	261
231.0-237.0	7105.1	6578.2	89.70	437.20	92.58	1.26	93.85	264
237.0-242.0	5921.0	5478.5	75.32	367.09	92.53	1.27	93.80	266

TABLE A-30. CUMULATIVE NO_x MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF NO_x EMITTED DURING TEST -- 10

HERCULES INC., RUN 10, INLET HV-23, OUTLET HV-13 UNIT A 1503-1905 3/13/75

TIME INTO CYCLE (MIN)	TOTAL NOX IN (GRAMS)	TOTAL NOX ADS. (GRAMS)	NOX USED FOR REGEN. (GRAMS)	TOTAL NOX EMIT. (GRAMS)	% NOX REDUC. DUE TO ADS.	% NOX REDUC. DUE TO REGEN.	AVG. % REDUC. OF NOX	AVG. PPM OF NOX EMIT.
0								
1.0	688.1	637.0	8.6	42.5	92.58	1.24	93.82	153
6.0	4418.6	4200.2	37.4	180.9	95.06	0.85	95.91	111
7.0	5259.3	5011.9	42.5	205.0	95.30	0.81	96.10	108
12.0	9934.9	9517.8	71.8	345.4	95.80	0.72	96.52	106
14.0	11912.3	11409.2	86.6	416.5	95.78	0.73	96.50	110
18.0	15802.6	15163.8	117.0	561.8	95.72	0.74	96.46	115
20.0	17622.1	17071.7	129.3	621.1	95.79	0.73	96.52	115
21.0	18769.2	17989.4	134.4	645.5	95.85	0.72	96.56	114
22.0	19711.4	18904.7	139.0	667.7	95.91	0.71	96.61	112
25.0	22627.5	21750.1	151.2	726.3	96.12	0.67	96.79	107
27.0	24608.5	23688.0	158.6	761.9	96.26	0.64	96.90	104
32.0	29406.4	28385.5	175.7	[illegible]	96.53	0.60	97.13	97
33.0	30369.7	29330.3	178.9	860.5	96.58	0.59	97.17	96
34.0	31311.5	30253.8	182.0	875.6	96.62	0.58	97.20	95
42.0	38721.8	37519.4	206.6	995.8	96.89	0.53	97.43	87
48.0	44593.7	43286.1	224.4	1083.2	97.07	0.50	97.57	83
50.0	46547.7	45206.0	230.1	1111.6	97.12	0.49	97.61	81
51.0	47521.3	46162.6	233.0	1125.7	97.14	0.49	97.63	81
53.0	49528.7	48136.3	238.7	1153.8	97.19	0.48	97.67	80
57.0	53496.8	52038.2	249.8	1208.7	97.27	0.47	97.74	78
63.0	59378.8	57820.0	266.7	1292.0	97.37	0.45	97.82	75
66.0	62414.9	60803.1	275.7	1336.2	97.42	0.44	97.86	74
68.0	64459.1	62809.1	282.1	1367.8	97.44	0.44	97.88	73
72.0	68562.5	66831.7	295.8	1435.2	97.48	0.43	97.91	73
78.0	74569.4	72705.6	318.1	1545.7	97.50	0.43	97.93	72
82.0	78466.6	76504.9	334.5	1627.2	97.50	0.43	97.93	72
84.0	80429.6	78415.3	343.2	1670.2	97.50	0.43	97.92	72
85.0	81424.7	79385.0	347.6	1692.1	97.49	0.43	97.92	72
87.0	83443.3	81349.8	356.6	1736.6	97.49	0.43	97.92	73
92.0	88378.3	86146.2	380.0	1851.8	97.47	0.43	97.90	73
93.0	89356.7	87095.8	384.9	1876.0	97.47	0.43	97.90	73
96.0	92187.4	89834.8	400.4	1952.2	97.45	0.43	97.88	74
98.0	93997.9	91581.7	411.1	2004.9	97.43	0.44	97.87	74
102.0	97778.8	95231.1	433.3	2114.3	97.39	0.44	97.84	75
117.0	113117.5	110017.5	526.3	2573.7	97.26	0.47	97.72	80
132.0	129115.5	125384.1	635.1	3096.3	97.11	0.49	97.60	85
137.0	134425.3	130468.7	673.8	3282.8	97.06	0.50	97.56	87
147.0	144835.3	140409.7	752.1	3673.5	96.94	0.52	97.46	90
152.0	150000.4	145331.3	792.7	3876.4	96.89	0.53	97.42	92
162.0	160556.8	155374.2	876.6	4303.9	96.77	0.55	97.32	96
167.0	165837.0	160433.3	924.3	4529.4	96.71	0.56	97.27	98
173.0	172179.8	166385.4	981.8	4812.6	96.63	0.57	97.20	100
177.0	176491.7	170370.9	1021.7	5009.2	96.58	0.58	97.16	102
187.0	187390.7	180733.6	1127.3	5529.8	96.45	0.60	97.05	107
189.0	188536.4	181813.5	1138.4	5584.5	96.43	0.60	97.04	107
192.0	193109.7	186116.2	1184.2	5809.3	96.38	0.61	96.99	109

TABLE A-30. CUMULATIVE NO_X MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF NO_X EMITTED DURING TEST -- 10 (CONTINUED)

HERCULES INC., RUN 10, INLET HV-23, OUTLET HV-13 UNIT A 1503-1905 3/13/75

TIME INTO CYCLE (MIN)	TOTAL NOX IN (GRAMS)	TOTAL NOX ADS. (GRAMS)	NOX USED FOR REGEN. (GRAMS)	TOTAL NOX EMIT. (GRAMS)	% NOX REDUC. DUE TO ADS.	% NOX REDUC. DUE TO REGEN.	AVG. % REDUC. OF NOX	AVG. PPM OF NOX EMIT.
207.0	210309.9	202221.3	1369.3	6719.3	96.15	0.65	96.81	117
217.0	222159.2	213279.0	1503.2	7377.1	96.00	0.68	96.68	123
223.0	229334.2	219556.0	1587.5	7790.6	95.91	0.69	96.60	126
225.0	231739.3	222160.8	1616.4	7932.1	95.88	0.70	96.58	127
231.0	238774.5	228705.1	1704.7	8364.8	95.78	0.71	96.50	131
237.0	245879.6	235283.3	1794.4	8802.0	95.69	0.73	96.42	134
242.0	251800.6	240761.9	1869.7	9169.0	95.62	0.74	96.36	137

TABLE A-31. SUMMARY OF CALCULATED NO_X MASS FLOW RATES AND CONTROL EFFICIENCIES FOR INSTANTANEOUS FLOW AND CONCENTRATION DATA FOR TEST -- 11

HERCULES INC., RUN 11, INLET HV-23, OUTLET HV-13 UNIT A 0711-1114 3/14/75

TIME INTO CYCLE (MIN)	INLET FLOW (SCFM)	REGEN. FLOW (SCFM)	INLET CONC. (PPM)	OUTLET CONC. (PPM)	MASS FLOW RATE IN (G/MIN)	MASS FLOW RATE ADS. (G/MIN)	MASS FLOW RATE REGEN. (G/MIN)	MASS FLOW RATE EMIT. (G/MIN)	% REDUC. OF NOX DUE TO ADS.	% REDUC. OF NOX DUE TO REGEN.	% REDUC. OF NOX
3.0	5500	1020	3340	190	1010.0	952.6	10.66	46.80	94.31	1.05	95.37
5.0	5500	1020	3320	90	1004.0	976.7	5.05	22.17	97.29	0.50	97.79
4.0	5500	1015	3360	82	1016.1	991.3	4.58	20.22	97.56	0.45	98.01
6.0	5500	1015	3310	78	1000.9	977.4	4.35	19.23	97.64	0.43	98.08
14.0	5475	1020	3220	112	969.3	935.6	6.28	27.43	95.52	0.65	97.17
15.0	5475	1020	3220	124	969.3	932.0	6.95	30.37	96.15	0.72	96.87
19.0	5450	1020	3380	101	1012.8	982.5	5.66	24.60	97.01	0.56	97.57
23.0	5450	1020	3390	81	1015.8	991.5	4.54	19.73	97.61	0.45	98.06
34.0	5475	1020	3290	64	990.4	971.1	3.59	15.68	98.05	0.36	98.42
37.0	5475	1020	3280	61	987.4	969.0	3.42	14.94	98.14	0.35	98.49
49.0	5475	1020	3260	58	981.3	963.9	3.25	14.21	98.22	0.33	98.55
57.0	5475	1020	3200	58	963.8	945.8	3.25	14.21	98.19	0.34	98.53
64.0	5475	1020	3150	61	948.2	929.9	3.42	14.94	98.06	0.36	98.42
77.0	5450	1020	3120	79	934.9	911.2	4.43	19.24	97.47	0.47	97.94
94.0	5475	1020	3110	95	936.2	907.6	5.33	23.27	95.95	0.57	97.51
97.0	5475	1020	3100	99	933.2	903.4	5.55	24.25	96.81	0.59	97.40
109.0	5475	1020	3100	114	933.2	898.9	6.39	27.92	95.32	0.69	97.01
124.0	5475	1020	3130	128	942.2	903.7	7.18	31.35	95.91	0.76	96.67
139.0	5475	1020	3090	141	930.2	887.7	7.91	34.54	95.44	0.85	96.29
154.0	5475	1020	3080	156	927.2	880.2	8.75	38.21	94.94	0.94	95.88
160.0	5450	1020	3060	164	916.9	867.8	9.23	39.95	94.64	1.00	95.64
169.0	5425	1020	3060	178	912.7	859.6	9.98	43.11	94.18	1.09	95.28
184.0	5450	1020	3050	200	913.9	854.0	11.22	48.71	93.44	1.23	94.67
199.0	5475	1020	2990	219	930.1	834.1	12.28	53.64	92.68	1.36	94.04
214.0	5475	1020	2960	230	891.0	821.8	12.90	56.34	92.23	1.45	93.68
220.0	5475	1020	2960	235	891.0	820.3	13.18	57.56	92.06	1.48	93.54
229.0	5475	1020	2940	240	885.0	812.8	13.46	58.79	91.84	1.52	93.36
243.0	5475	1020	2880	246	866.9	792.9	13.80	60.26	91.46	1.59	93.05

TABLE A-32. SUMMARY OF NO_X MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF NO_X EMITTED FOR INTERVALS DURING TEST -- 11

HERCULES INC., RUN 11, INLET HV-23, OUTLET HV-13 UNIT A 0711-1114 3/14/75

INTERVAL OF CYCLE (MIN)	NOX IN DURING INTERVAL (GRAMS)	NOX ADSORBED DURING INTERVAL (GRAMS)	NOX REGEN. DURING INTERVAL (GRAMS)	NOX EMITTED DURING INTERVAL (GRAMS)	PERCENT OF NOX ADSORBED DURING INTERVAL	PERCENT NOX FOR REGEN. DURING INTERVAL	PERCENT REDUC. OF NOX DURING INTERVAL	AVERAGE PPM OF NOX EMIT. DURING INTERVAL
0.0- 3.0	3021.0	2894.0	23.55	103.45	95.80	0.78	96.58	140
3.0- 4.0	1010.0	984.0	4.81	21.19	97.43	0.48	97.90	86
4.0- 6.0	2017.0	1968.6	8.93	39.45	97.60	0.44	98.04	80
6.0- 14.0	7880.9	7651.7	42.54	186.67	97.09	0.54	97.63	95
14.0- 15.0	969.3	933.8	6.62	28.90	96.34	0.68	97.02	118
15.0- 19.0	3964.2	3829.0	25.24	109.95	96.59	0.64	97.23	113
19.0- 23.0	4057.2	3948.2	20.41	88.66	97.31	0.50	97.81	91
23.0- 34.0	11034.0	10794.5	44.72	194.73	97.83	0.41	98.24	72
34.0- 39.0	4944.3	4850.2	17.53	76.54	98.10	0.35	98.45	62
39.0- 49.0	9843.5	9664.4	33.37	145.74	98.18	0.34	98.52	60
49.0- 59.0	9723.1	9548.5	32.53	142.07	98.20	0.33	98.54	58
59.0- 64.0	4778.7	4689.2	16.68	72.87	98.13	0.35	98.48	59
64.0- 79.0	14123.5	13808.2	58.89	256.38	97.77	0.42	98.18	70
79.0- 94.0	14033.2	13641.1	73.19	318.84	97.21	0.52	97.73	87
94.0- 97.0	2804.0	2716.4	16.32	71.28	96.88	0.58	97.46	97
97.0-109.0	11198.1	10813.4	71.67	313.04	96.56	0.64	97.20	106
109.0-124.0	14065.3	13519.0	101.79	444.57	96.12	0.72	96.84	121
124.0-139.0	14042.7	13435.4	113.14	494.17	95.68	0.81	96.48	134
139.0-154.0	13929.9	13259.3	124.92	545.61	95.19	0.90	96.08	148
154.0-160.0	5532.2	5243.9	53.84	234.47	94.79	0.97	95.76	160
160.0-169.0	8233.4	7773.3	86.31	373.75	94.41	1.05	95.46	171
169.0-184.0	13699.9	12852.2	158.99	688.68	93.81	1.16	94.97	189
184.0-199.0	13604.9	12661.0	176.23	767.67	93.06	1.30	94.36	210
199.0-214.0	13433.2	12419.5	188.85	824.84	92.45	1.41	93.86	224
214.0-220.0	5346.2	4926.3	78.23	341.69	92.15	1.46	93.61	232
220.0-229.0	7992.2	7348.7	119.87	523.56	91.95	1.50	93.45	238
229.0-243.0	12263.7	11239.6	190.79	833.29	91.65	1.56	93.21	243

TABLE A-33. CUMULATIVE NO_X MASS LOADING, AVERAGE CONTROL EFFICIENCY AND AVERAGE CONCENTRATION OF NO_X EMITTED DURING TEST -- 11

HERCULES INC., RUN 11, INLET HV-23, OUTLET HV-13 UNIT A 0711-1114 3/14/75

TIME INTO CYCLE (MIN)	TOTAL NOX IN (GRAMS)	TOTAL NOX ADS. (GRAMS)	NOX USED FOR REGEN. (GRAMS)	TOTAL NOX EMIT. (GRAMS)	% NOX REDUC. DUE TO ADS.	% NOX REDUC. DUE TO REGEN.	AVG. % REDUC. OF NOX	AVG. PPM OF NOX EMIT.
0								
3.0	3021.0	2894.0	23.6	103.5	95.80	0.78	96.58	140
4.0	4031.0	3878.0	28.4	124.6	96.20	0.70	96.91	126
6.0	6048.0	5846.6	37.3	164.1	96.67	0.62	97.29	111
14.0	13928.9	13498.3	79.8	350.8	96.91	0.57	97.48	102
15.0	14898.2	14432.1	86.4	379.7	96.87	0.58	97.45	103
19.0	18862.4	18261.1	111.7	489.6	96.81	0.59	97.40	105
23.0	22919.7	22209.3	132.1	578.3	96.90	0.58	97.48	103
34.0	33953.6	33003.8	176.8	773.0	97.20	0.52	97.72	93
39.0	38897.9	37854.0	194.3	849.6	97.32	0.50	97.82	89
49.0	48741.4	47518.4	227.7	995.3	97.49	0.47	97.96	83
59.0	58464.5	57366.8	260.2	1137.4	97.61	0.45	98.05	79
64.0	63243.2	61756.0	276.9	1210.2	97.65	0.44	98.09	77
79.0	77366.7	75564.2	335.8	1466.6	97.67	0.43	98.10	76
94.0	91399.8	89205.4	409.0	1785.4	97.60	0.45	98.05	78
97.0	94203.9	91921.8	425.3	1856.7	97.58	0.45	98.03	78
109.0	105401.9	102735.2	497.0	2169.8	97.47	0.47	97.94	81
124.0	119467.3	116254.2	598.8	2614.3	97.31	0.50	97.81	86
139.0	133513.9	129689.6	711.9	3108.5	97.14	0.53	97.67	91
154.0	147439.9	142948.9	836.8	3654.1	96.95	0.57	97.52	97
163.0	152972.1	148192.8	890.7	3888.6	96.88	0.58	97.46	99
169.0	161205.5	155966.2	977.0	4262.3	96.75	0.61	97.36	103
184.0	174905.4	168818.4	1136.0	4951.0	96.52	0.65	97.17	110
199.0	188513.3	181479.4	1312.2	5718.7	96.27	0.70	96.97	118
214.0	201943.5	193898.9	1501.1	6543.5	96.02	0.74	96.76	125
223.0	207289.6	198825.1	1579.3	6885.2	95.92	0.76	96.68	128
229.0	215281.8	206173.9	1699.2	7408.8	95.77	0.79	96.56	132
243.0	227545.5	217413.5	1890.0	8242.1	95.55	0.83	96.38	139

APPENDIX B

NO_X EMISSION DATA REPORTS FOR EPA METHOD NO. 7 TESTS

OXIDES OF NITROGEN (AS NO2) DATA AND RESULTS

RUN ID	DATE	TIME	NO.	FLASK VOL ML	PRESSURES -- IN.HG INL BARO	FLASK VAC	FNL BARO	FNL FLAS	TEMP F INL	FNL	N MASS UG	FLOW RATE SCFM	NOX PPM	NOX RATE LB/HR
1-HV-12-1	3/5	1316	3	1965	29.75	26.50	29.76	0.50	75	71	7550	5700	2334	95.04
1-HV-12-2	3/5	1345	5	1955	29.74	26.65	29.77	4.90	74	70	6550	5700	2426	98.77
1-HV-12-3	3/5	1415	19	2116	29.72	26.60	29.78	0.05	75	70	8900	5975	2490	106.28
1-HV-12-4	3/5	1446	9	2053	29.71	26.60	29.77	0.60	75	73	7650	5975	2267	96.79
1-HV-12-5	3/5	1516	20	2069	29.71	26.70	29.73	0.20	70	81	10500	5975	3088	131.83
1-HV-12-6	3/5	1545	13	2071	29.70	26.60	29.73	0.0	73	76	10500	5675	3039	123.21
1-HV-12-7	3/5	1645	15	2064	29.68	26.65	29.72	0.05	68	75	10650	5650	3089	124.68
1-HV-12-8	3/5	1745	1	2039	29.66	26.60	29.76	0.85	71	71	7200	5700	2159	87.92
2-HV-12-9	3/6	1015	1	2039	29.78	26.40	29.65	0.45	75	74	6850	5575	2068	82.35
2-HV-12-10	3/6	1115	3	1965	29.77	26.60	29.64	5.85	73	73	7250	5725	2840	116.16
2-HV-12-11	3/6	1215	5	1955	29.76	26.65	29.64	1.95	73	73	9900	5725	3270	133.76
2-HV-12-12	3/6	1316	19	2116	29.75	26.50	29.63	0.05	74	73	11850	5650	3372	136.12
3-HV-12-13	3/6	1415	9	2053	29.73	26.35	29.61	1.75	74	73	8350	5875	2635	110.60
3-HV-12-14	3/6	1515	20	2069	29.73	26.40	29.60	1.05	74	72	10150	5850	3078	128.65
3-HV-12-15	3/6	1616	13	2071	29.71	26.50	29.61	0.45	75	73	9100	5875	2685	112.68
3-HV-12-16	3/6	1715	15	2064	29.70	26.45	29.58	6.10	73	74	6900	5325	2627	99.94
4-HV-12-17	3/7	0915	1	2039	29.65	26.45	29.83	2.10	74	67	6850	5700	2145	87.34
4-HV-12-18	3/7	1015	3	1965	29.63	26.65	29.84	0.90	73	65	5900	4475	1805	57.71
4-HV-12-19	3/7	1115	5	1955	29.61	26.25	29.84	4.85	72	65	11200	5700	4133	168.30
4-HV-12-20	3/6	1215	19	2116	29.61	26.35	29.85	1.75	72	64	14000	5775	4145	170.99

OXIDES OF NITROGEN (AS NO2) DATA AND RESULTS

RUN ID	DATE	TIME	NO.	FLASK VOL ML	PRESSURES -- IN.HG INL BARO	FLASK VAC	FNL BARO	FNL FLAS	TEMP F INL	FNL	N MASS UG	FLOW RATE SCFM	NOX PPM	NOX RATE LB/HR
5-HV-12-21	3/7	1316	9	2053	29.60	26.50	29.84	3.55	73	65	8600	5675	2817	114.21
5-HV-12-22	3/6	1415	20	2069	29.58	26.25	29.82	4.10	76	65	8200	5725	2757	112.78
5-HV-12-23	3/7	1517	13	2071	29.56	26.50	29.82	1.75	77	65	9000	5450	2708	105.42
5-HV-12-24	3/7	1615	15	2064	29.53	26.35	29.82	4.10	75	65	6850	5550	2295	90.98
5-HV-12-25	3/7	1658	6	2073	29.54	26.50	29.82	1.00	78	65	9800	5550	2857	113.28
6-HV-12-26	3/11	1415	1	2039	29.65	27.35	29.51	0.55	74	78	3650	4250	1076	32.67
6-HV-12-27	3/11	1445	3	1965	29.65	27.10	29.51	0.80	73	78	2300	4350	717	22.30
6-HV-12-28	3/11	1515	5	1955	29.62	26.75	29.50	0.20	75	78	3650	4350	1132	35.20
6-HV-12-29	3/11	1545	21	2080	29.62	26.60	29.53	7.50	77	78	4600	5175	1863	68.88
6-HV-12-30	3/11	1620	26	2055	29.61	26.65	29.53	0.70	74	78	2800	5200	844	31.36
6-HV-12-31	3/11	1645	20	2069	29.60	26.75	29.55	2.25	75	77	3450	5200	1090	40.51
6-HV-12-32	3/11	1715	8	2058	29.60	26.75	29.55	1.50	73	75	5150	5175	1582	58.48
6-HV-12-33	3/11	1745	15	2064	29.60	26.65	29.50	0.90	77	76	4750	5175	1431	52.90
7-HV-12-34	3/12	1023	1	2039	29.53	26.55	29.46	0.65	77	75	4750	4300	1435	44.10
7-HV-12-35	3/12	1117	3	1965	29.53	26.45	29.47	1.05	78	73	9000	4300	2866	88.04
7-HV-12-36	3/12	1215	5	1955	29.55	26.45	29.46	2.05	78	72	8550	4300	2846	87.44
7-HV-12-37	3/12	1316	19	2116	29.55	26.35	29.42	0.05	78	68	9500	4325	2689	83.09
8-HV-12 38	3/12	1430	22	2063	29.54	26.40	29.42	0.45	78	68	8150	5025	2398	86.09
8-HV-12-39	3/12	1516	20	2069	29.54	26.20	29.33	0.20	77	74	9550	5050	2842	102.54
8-HV-12-40	3/12	1615	8	2058	29.50	26.40	29.33	0.0	77	70	9600	5025	2801	100.55

OXIDES OF NITROGEN (AS NO2) DATA AND RESULTS

RUN ID	DATE	TIME	NO.	FLASK VOL ML	PRESSURES -- IN.HG INL BARO	FLASK VAC	FNL BARO	FNL FLAS	TEMP F INL	FNL	N MASS UG	FLOW RATE SCFM	NOX PPM	NOX RATE LB/HR
8-HV-12-41	3/12	1745	15	2064	29.48	26.35	29.32	0.40	76	71	8150	5025	2417	86.77
9-HV-12-42	3/13	1047	1	2039	29.44	26.35	29.56	2.90	70	59	3750	3040	1202	26.11
9-HV-12-43	3/13	1132	3	1965	29.43	26.25	29.59	3.30	68	58	5500	5000	1863	66.57
9-HV-12 44	3/13	1219	5	1955	29.41	26.35	29.63	3.60	70	59	9750	5825	3347	139.28
9-HV-12-45	3/13	1317	19	2116	29.39	26.30	29.65	2.25	73	59	11000	5825	3291	136.96
10HV-12-46	3/13	1530	22	2063	29.32	26.30	29.70	2.65	73	59	7200	5975	2236	95.45
10HV-12-47	3/13	1632	20	2069	29.32	26.35	29.70	1.35	77	59	5550	6075	1626	70.58
10HV-12-48	3/13	1732	8	2058	29.35	26.30	29.70	2.25	70	59	9350	6150	2869	126.05
10HV-12-49	3/13	1847	15	2064	29.26	26.25	29.70	1.85	72	60	10450	6050	3146	135.97
11HV-12-50	3/14	0747	1	2039	29.59	26.45	29.79	0.65	60	51	11000	5475	3150	123.19
11HV-12-51	3/14	0847	3	1965	29.62	26.50	29.79	0.75	60	51	9500	5475	2833	110.79
11HV-12-52	3/14	0947	5	1955	29.63	26.70	29.79	0.35	60	54	13150	5475	3879	151.73
11HV-12-53	3/14	1047	19	2116	29.66	29.65	29.79	1.35	59	54	9550	5475	2428	94.96
1-HV-13-01	3/5	1258	2	2035	29.75	26.40	29.76	0.05	73	71	355	4675	104	3.49
1-HV-13-02	3/5	1318	4	2041	29.75	26.65	29.76	1.50	75	70	380	4675	116	3.89
1-HV-13-03	3/5	1350	23	1984	29.74	26.50	29.77	0.05	73	70	450	4950	135	4.78
1-HV-13-04	3/5	1420	21	2080	29.72	26.55	29.78	0.0	75	73	237	4955	67	2.40
1-HV-13-05	3/5	1454	24	2053	29.71	26.20	29.77	1.25	75	73	265	4925	81	2.88
1-HV-13-06	3/5	1520	25	2076	29.71	26.55	29.73	0.45	73	73	244	4950	71	2.52
1-HV-13-07	3/5	1550	14	2124	29.70	26.55	29.72	1.20	73	74	295	4650	87	2.89

OXIDES OF NITROGEN (AS NO2) DATA AND RESULTS

RUN ID	DATE	TIME	NO.	FLASK VOL ML	PRESSURES -- IN.HG INL BARO	FLASK VAC	FNL BARO	FNL FLAS	TEMP F INL	FNL	N MASS UG	FLOW RATE SCFM	NOX PPM	NOX RATE LB/HR
1-HV-13-08	3/5	1650	16	2071	29.68	26.55	29.72	1.40	70	74	470	4625	143	4.74
1-HV-13-09	3/5	1750	18	2078	29.66	26.60	29.70	2.00	71	74	506	4650	157	5.22
2-HV-13-10	3/6	1021	2	2035	29.78	26.65	29.65	0.65	73	73	336	4520	101	3.27
2-HV-13-11	3/6	1120	4	2041	29.77	26.65	29.64	0.10	73	73	167	4675	49	1.64
2-HV-13-12	3/6	1220	23	1984	29.76	26.55	29.63	1.45	72	73	280	4700	89	3.01
2-HV-13-13	3/6	1320	21	2080	29.75	26.45	29.61	5.75	74	72	354	4580	131	4.29
3-HV-13-14	3/6	1420	24	2053	29.73	26.40	29.61	0.50	74	72	540	4835	161	5.58
3-HV-13-15	3/6	1520	25	2076	29.73	26.50	29.61	4.55	74	73	235	4815	82	2.83
3-HV-13-16	3/6	1621	14	2124	29.71	26.40	29.60	1.45	75	73	330	4840	99	3.43
4-HV-13-17	3/7	0921	2	2035	29.65	26.50	29.84	1.45	73	64	118	4685	35	1.20
4-HV-13-18	3/7	1021	4	2041	29.63	26.45	29.84	0.35	73	64	103	3480	29	0.74
4-HV-13-19	3/7	1121	23	1984	29.61	26.55	29.84	0.65	72	65	466	4690	140	4.70
4-HV-13-20	3/7	1220	21	2080	29.61	26.50	29.84	1.75	72	65	522	4765	156	5.33
5-HV-13-21	3/7	1320	24	2053	29.60	26.45	29.84	0.90	73	65	200	4655	58	1.96
5-HV-13-22	3/7	1420	25	2076	29.58	26.40	29.83	2.25	76	65	265	4630	81	2.70
5-HV-13-23	3/7	1524	14	2124	29.56	26.45	29.82	2.15	77	65	208	4430	62	1.97
5-HV-13-24	3/7	1620	16	2071	29.53	26.50	29.82	2.60	75	65	420	4530	130	4.23
5-HV-13-25	3/7	1654	18	2078	29.54	26.45	29.82	3.70	77	65	290	4530	94	3.05
6-HV-13-26	3/11	1420	2	2035	29.65	27.00	29.51	0.50	74	77	135	3265	40	0.94
6-HV-13-27	3/11	1450	4	2041	29.65	26.85	29.51	0.25	73	77	30	3320	8	0.21

OXIDES OF NITROGEN (AS NO2) DATA AND RESULTS

RUN ID	DATE	TIME	NO.	FLASK VOL ML	PRESSURES -- IN.HG INL BARO	FLASK VAC	FNL BARO	FNL FLAS	TEMP P INL	FNL	N MASS UG	FLOW RATE SCFM	NOX PPM	NOX RATE LB/HR
6-HV-13-28	3/11	1520	23	1984	29.62	26.65	29.53	0.0	75	78	38	3320	11	0.27
6-HV-13-29	3/11	1521	19	2116	29.62	26.70	29.53	0.0	77	78	340	3320	96	2.29
6-HV-13-30	3/11	1620	9	2053	29.61	26.65	29.55	3.80	73	79	122	4175	41	1.25
6-HV-13-31	3/11	1645	25	2076	29.61	26.70	29.55	4.50	75	77	68	4175	23	0.71
6-HV-13-32	3/11	1721	14	2124	29.60	26.60	29.54	1.60	75	76	78	4150	23	0.70
6-HV-13-33	3/11	1750	16	2071	29.60	26.60	29.50	0.50	75	77	90	4150	26	0.79
7-HV-13-34	3/12	1028	2	2035	29.53	26.45	29.47	0.45	77	76	180	3275	54	1.27
7-HV-13-35	3/12	1120	4	2041	29.53	26.50	29.47	0.65	78	73	165	3275	49	1.16
7-HV-13-36	3/12	1220	23	1984	29.55	26.50	29.46	0.75	78	71	210	3280	65	1.53
8-HV-13-38	3/12	1430	26	2055	29.55	26.45	29.41	0.40	78	71	158	4030	46	1.35
8-HV-13-39	3/12	1520	25	2076	29.54	26.55	29.33	1.60	77	75	159	4030	49	1.42
8-HV-13-40	3/12	1620	14	2124	29.50	26.45	29.35	1.05	77	70	295	4005	86	2.48
8-HV-13-41	3/12	1720	16	2071	[illegible]	26.40	29.33	0.05	76	70	351	4005	101	2.92
9-HV-13-42	3/13	1069	2	2035	29[illegible]	[illegible].40	29.59	1.60	70	59	140	2010	42	0.61
9-HV-13-43	3/13	1135	4	2041	29.4[illegible]	[illegible]	29.59	3.00	68	59	114	4140	36	1.09
9-HV-13-44	3/13	1200	23	1984	29.41	26.[illegible]	29.62	1.85	68	59	206	4760	64	2.19
9-HV-13-45	3/13	1325	6	2073	29.39	26.35	29.65	3.25	73	59	354	4770	112	3.83
10HV-13-46	3/13	1535	26	2055	29.33	26.30	29.70	1.45	73	61	197	4975	58	2.09
10HV-13-47	3/13	1635	25	2076	29.32	26.30	29.60	3.40	69	61	316	5050	101	3.67
10HV-13-48	3/13	1735	14	2124	29.35	26.25	29.70	1.85	70	60	158	5125	46	1.70

OXIDES OF NITROGEN (AS NO2) DATA AND RESULTS

RUN ID	DATE	TIME	NO.	FLASK VOL ML	PRESSURES -- IN.HG INL BARO	FLASK VAC	FNL BARO	FNL FLAS	TEMP F INL	FNL	N MASS UG	FLOW RATE SCFM	NOX PPM	NOX RATE LB/HR
10HV-13-49	3/13	1850	16	2071	29.26	26.20	29.70	1.75	72	60	308	5025	92	3.31
11HV-13-50	3/14	0750	2	2035	29.59	26.50	29.79	1.85	60	51	225	4455	67	2.15
11HV-13-51	3/14	0850	4	2041	29.62	26.55	29.79	4.10	60	51	281	4455	92	2.94
11HV-13-52	3/14	0951	23	1984	29.63	26.70	29.79	2.95	60	54	634	4430	204	6.44
11HV-13-53	3/14	1050	6	2073	29.66	26.50	29.79	0.20	59	54	820	4455	228	7.28
9-HV-23-01	3/13	1045	27	2092	29.44	26.20	29.56	0.75	70	59	7150	3040	2059	44.72
9-HV-23-02	3/13	1130	2	2035	29.43	26.40	29.59	1.90	68	59	5150	5000	1582	56.52
9-HV-23-03	3/13	1217	28	2064	29.41	26.45	29.63	2.20	70	59	10250	5825	3127	130.13
9-HV-23-04	3/13	1315	29	2089	29.39	26.35	29.63	1.10	73	59	13150	5825	3802	158.23
10HV-23-05	3/13	1530	10	2050	29.32	26.25	29.70	1.90	73	59	8250	5975	2506	106.96
10HV-23-06	3/13	1630	11	2052	29.32	26.35	29.70	0.90	73	59	10150	6075	2949	128.00
10HV-23-07	3/13	1730	12	2067	29.36	26.40	29.70	1.05	70	58	12000	6150	3475	152.67
10HV-23-08	3/13	1845	17	2073	29.26	26.20	29.70	1.05	72	58	11650	6050	3375	145.87
11HV-23-09	3/14	0745	27	2092	29.59	26.45	29.79	0.45	60	51	11000	5475	3045	119.12
11HV-23-10	3/14	0845	4	2041	29.62	26.35	29.79	3.20	60	51	11500	5475	3666	143.40
11HV-23-11	3/14	0945	28	2064	29.63	26.50	29.79	4.00	60	54	7750	5475	2531	98.99
11HV-23-12	3/14	1045	7	2099	29.66	26.60	29.79	0.40	59	55	10250	5475	2840	111.07
CAL GAS 1	3/6		6	2073	29.76	26.75	29.53	8.78	79	74	6250	1	2700	0.02
CAL GAS 2	3/6		7	2099	29.76	26.65	29.80	2.85	75	66	13350	1	4167	0.03
CAL GAS 3	3/6		8	2058	29.76	26.50	29.80	2.35	63	68	12750	1	4030	0.03

OXIDES OF NITROGEN (AS NO2) DATA AND RESULTS

RUN ID	DATE	TIME	NO.	FLASK VOL ML	PRESSURES -- IN.HG INL BARO	FLASK VAC	FNL BARO	FNL FLAS	TEMP F INL	FNL	N MASS UG	FLOW RATE SCFM	NOX PPM	NOX RATE LB/HR
CAL GAS 4	3/7		10	2050	29.76	26.60	29.80	0.0	74	68	142	1	40	0.00
CAL GAS 5	3/7		11	2052	29.75	26.65	29.80	0.0	74	68	138	1	39	0.00
CAL GAS 6	3/7		12	2067	29.75	26.60	29.80	1.60	74	68	142	1	43	0.00

APPENDIX C

EPA REFERENCE METHOD NO. 7

tilled water and add these washings to the same storage container.

4.3 Sample analysis. Transfer the contents of the storage container to a 50 ml. volumetric flask. Dilute to the mark with deionized, distilled water. Pipette a 10 ml. aliquot of this solution into a 125 ml. Erlenmeyer flask. Add 40 ml. of isopropanol and two to four drops of thorin indicator. Titrate to a pink endpoint using 0.01 *N* barium perchlorate. Run a blank with each series of samples.

5. *Calibration.*

5.1 Use standard methods and equipment which have been approved by the Administrator to calibrate the rotameter, pitot tube, dry gas meter, and probe heater.

5.2 Standardize the barium perchlorate against 25 ml. of standard sulfuric acid containing 100 ml. of isopropanol.

6. *Calculations.*

6.1 Dry gas volume. Correct the sample volume measured by the dry gas meter to standard conditions (70° F. and 29.92 inches Hg) by using equation 6-1.

$$V_{m_{std}} = V_m \left(\frac{T_{std}}{T_m}\right)\left(\frac{P_{bar}}{P_{std}}\right) = 17.71 \frac{°R}{\text{in. Hg}}\left(\frac{V_m P_{bar}}{T_m}\right) \qquad \text{equation 6-1}$$

where:

$V_{m_{std}}$ = Volume of gas sample through the dry gas meter (standard conditions), cu. ft.

V_m = Volume of gas sample through the dry gas meter (meter conditions), cu. ft.

T_{std} = Absolute temperature at standard conditions, 530° R.

T_m = Average dry gas meter temperature, °R.

P_{bar} = Barometric pressure at the orifice meter, inches Hg.

P_{std} = Absolute pressure at standard conditions, 29.92 inches Hg.

6.2 Sulfur dioxide concentration.

$$C_{SO_2} = \left(7.05 \times 10^{-6} \frac{\text{lb.-l.}}{\text{g.-ml.}}\right) \frac{(V_t - V_{tb}) N \left(\frac{V_{soln}}{V_a}\right)}{V_{m_{std}}} \qquad \text{equation 6-2}$$

where:

C_{SO_2} = Concentration of sulfur dioxide at standard conditions, dry basis, lb./cu. ft.

7.05×10^{-6} = Conversion factor, including the number of grams per gram equivalent of sulfur dioxide (32 g./g.-eq.), 453.6 g./lb., and 1,000 ml./l., lb.-l./g.-ml.

V_t = Volume of barium perchlorate titrant used for the sample, ml.

V_{tb} = Volume of barium perchlorate titrant used for the blank, ml.

N = Normality of barium perchlorate titrant, g.-eq./l.

V_{soln} = Total solution volume of sulfur dioxide, 50 ml.

V_a = Volume of sample aliquot titrated, ml.

$V_{m_{std}}$ = Volume of gas sample through the dry gas meter (standard conditions), cu. ft., see Equation 6-1.

7. *References.*

Atmospheric Emissions from Sulfuric Acid Manufacturing Processes, U.S. DHEW, PHS, Division of Air Pollution, Public Health Service Publication No. 999-AP-13, Cincinnati, Ohio, 1965.

Corbett, P. F., The Determination of SO_2 and SO_3 in Flue Gases, Journal of the Institute of Fuel, 24:237-243, 1961.

Matty, R. E. and E. K. Diehl, Measuring Flue-Gas SO_2 and SO_3, Power *101*:94-97, November, 1957.

Patton, W. F. and J. A. Brink, Jr., New Equipment and Techniques for Sampling Chemical Process Gases, J. Air Pollution Control Association, *13*, 162 (1963).

METHOD 7—DETERMINATION OF NITROGEN OXIDE EMISSIONS FROM STATIONARY SOURCES

1. *Principle and applicability.*

1.1 Principle. A grab sample is collected in an evacuated flask containing a dilute sulfuric acid-hydrogen peroxide absorbing solution, and the nitrogen oxides, except nitrous oxide, are measure colorimetrically using the phenoldisulfonic acid (PDS) procedure.

1.2 Applicability. This method is applicable for the measurement of nitrogen oxides from stationary sources only when specified by the test procedures for determining compliance with New Source Performance Standards.

2. *Apparatus.*

2.1 Sampling. See Figure 7-1.

2.1.1 Probe—Pyrex[1] glass, heated, with filter to remove particulate matter. Heating is unnecessary if the probe remains dry during the purging period.

2.1.2 Collection flask—Two-liter, Pyrex,[1] round bottom with short neck and 24/40 standard taper opening, protected against implosion or breakage.

2.1.3 Flask valve—T-bore stopcock connected to a 24/40 standard taper joint.

2.1.4 Temperature gauge—Dial-type thermometer, or equivalent, capable of measuring 2° F. intervals from 25° to 125° F.

2.1.5 Vacuum line—Tubing capable of withstanding a vacuum of 3 inches Hg absolute pressure, with "T" connection and T-bore stopcock, or equivalent.

2.1.6 Pressure gauge—U-tube manometer, 36 inches, with 0.1-inch divisions, or equivalent.

[1] Trade name.

valve to its "vent" position and turn off the pump. Check the manometer for any fluctuation in the mercury level. If there is a visible change over the span of one minute, check for leaks. Record the initial volume, temperature, and barometric pressure. Turn the flask valve to its "purge" position, and then do the same with the pump valve. Purge the probe and the vacuum tube using the squeeze bulb. If condensation occurs in the probe and flask valve area, heat the probe and purge until the condensation disappears. Then turn the pump valve to its "vent" position. Turn the flask valve to its "sample" position and allow sample to enter the flask for about 15 seconds. After collecting the sample, turn the flask valve to its "purge" position and disconnect the flask from the sampling train. Shake the flask for 5 minutes.

4.2 Sample recovery.

4.2.1 Let the flask set for a minimum of 16 hours and then shake the contents for 2 minutes. Connect the flask to a mercury filled U-tube manometer, open the valve from the flask to the manometer, and record the flask pressure and temperature along with the barometric pressure. Transfer the flask contents to a container for shipment or to a 250 ml. beaker for analysis. Rinse the flask with two portions of distilled water (approximately 10 ml.) and add rinse water to the sample. For a blank use 25 ml. of absorbing solution and the same volume of distilled water as used in rinsing the flask. Prior to shipping or analysis, add sodium hydroxide (1*N*) dropwise into both the sample and the blank until alkaline to litmus paper (about 25 to 35 drops in each).

4.3 Analysis.

4.3.1 If the sample has been shipped in a container, transfer the contents to a 250 ml. beaker using a small amount of distilled water. Evaporate the solution to dryness on a steam bath and then cool. Add 2 ml. phenoldisulfonic acid solution to the dried residue and triturate thoroughly with a glass rod. Make sure the solution contacts all the residue. Add 1 ml. distilled water and four drops of concentrated sulfuric acid. Heat the solution on a steam bath for 3 minutes with occasional stirring. Cool, add 20 ml. distilled water, mix well by stirring, and add concentrated ammonium hydroxide dropwise with constant stirring until alkaline to litmus paper. Transfer the solution to a 100 ml. volumetric flask and wash the beaker three times with 4 to 5 ml. portions of distilled water. Dilute to the mark and mix thoroughly. If the sample contains solids, transfer a portion of the solution to a clean, dry centrifuge tube, and centrifuge, or filter a portion of the solution. Measure the absorbance of each sample at 420 nm. using the blank solution as a zero. Dilute the sample and the blank with a suitable amount of distilled water if absorbance falls outside the range of calibration.

5. *Calibration.*

5.1 Flask volume. Assemble the flask and flask valve and fill with water to the stopcock. Measure the volume of water to ±10 ml. Number and record the volume on the flask.

5.2 Spectrophotometer. Add 0.0 to 16.0 ml. of standard solution to a series of beakers. To each beaker add 25 ml. of absorbing solution and add sodium hydroxide (1*N*) dropwise until alkaline to litmus paper (about 25 to 35 drops). Follow the analysis procedure of section 4.3 to collect enough data to draw a calibration curve of concentration in μg. NO_2 per sample versus absorbance.

6. *Calculations.*

6.1 Sample volume.

$$V_{sd} = \frac{T_{std}(V_f - V_a)}{P_{std}}\left(\frac{P_f}{T_f} - \frac{P_i}{T_i}\right) = \left(17.71\ \frac{°R}{in.\ H_g}\right)(V_f - 25\ ml.)\left(\frac{P_f}{T_f} - \frac{P_i}{T_i}\right) \quad \text{Equation 7-1}$$

where:

V_{sd} = Sample volume at standard conditions (dry basis), ml.

T_{std} = Absolute temperature at standard conditions, 530° R.

P_{std} = Pressure at standard conditions, 29.92 inches Hg.

V_f = Volume of flask and valve, ml.

V_a = Volume of absorbing solution, 25 ml.

P_f = Final absolute pressure of flask, inches Hg.

P_i = Initial absolute pressure of flask, inches Hg.

T_f = Final absolute temperature of flask, °R.

T_i = Initial absolute temperature of flask, °R.

6.2 Sample concentration. Read μg. NO_2 for each sample from the plot of μg. NO_2 versus absorbance.

$$C = \left(\frac{m}{V_{sd}}\right)\left(\frac{\frac{1\ lb.}{cu.\ ft.}}{1.6\times10^{10}\frac{\mu g.}{ml.}}\right) = \left(6.2\times10^{-9}\frac{lb./s.c.f.}{\mu g./ml.}\right)\left(\frac{m}{V_{sd}}\right) \quad \text{equation 7-2}$$

where:

C = Concentration of NO_x as NO_2 (dry basis), lb./s.c.f.

m = Mass of NO_2 in gas sample, μg.

V_{sd} = Sample volume at standard conditions (dry basis), ml.

7. *References.*

Standard Methods of Chemical Analysis. 6th ed. New York, D. Van Nostrand Co., Inc., 1962, vol. 1, p. 329–330.

Standard Method of Test for Oxides of Nitrogen in Gaseous Combustion Products

2.1.7 Pump—Capable of producing a vacuum of 3 inches Hg absolute pressure.

2.1.8 Squeeze bulb—One way.

2.2 Sample recovery.

2.2.1 Pipette or dropper.

2.2.2 Glass storage containers—Cushioned for shipping.

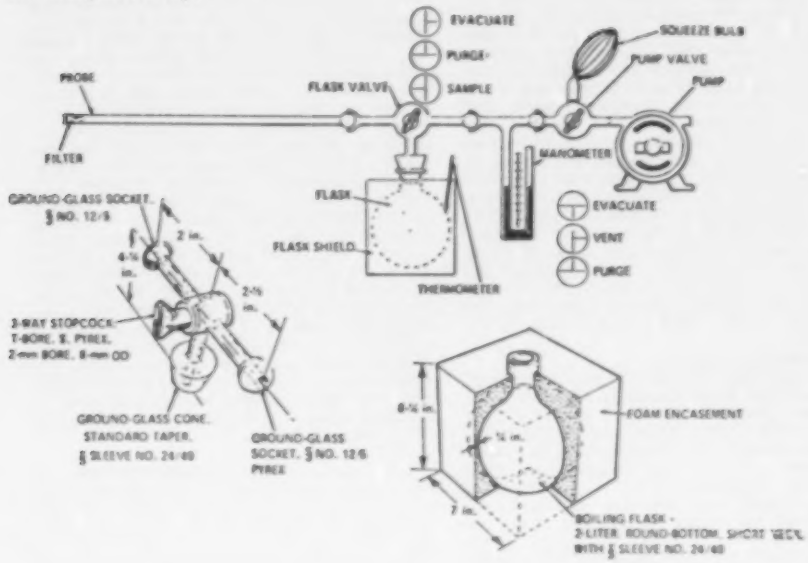


Figure 7-1. Sampling train, flask valve, and flask.

2.2.3. Glass wash bottle.

2.3 Analysis.

2.3.1 Steam bath.

2.3.2 Beakers or casseroles—250 ml., one for each sample and standard (blank).

2.3.3 Volumetric pipettes—1, 2, and 10 ml.

2.3.4 Transfer pipette—10 ml. with 0.1 ml. divisions.

2.3.5 Volumetric flask—100 ml., one for each sample, and 1,000 ml. for the standard (blank).

2.3.6 Spectrophotometer—To measure absorbance at 420 nm.

2.3.7 Graduated cylinder—100 ml. with 1.0 ml. divisions.

2.3.8 Analytical balance—To measure to 0.1 mg.

3. *Reagents.*

3.1 Sampling.

3.1.1 Absorbing solution—Add 2.8 ml. of concentrated H_2SO_4 to 1 liter of distilled water. Mix well and add 6 ml. of 3 percent hydrogen peroxide. Prepare a fresh solution weekly and do not expose to extreme heat or direct sunlight.

3.2 Sample recovery.

3.2.1 Sodium hydroxide (1*N*)—Dissolve 40 g. NaOH in distilled water and dilute to 1 liter.

3.2.2 Red litmus paper.

3.2.3 Water—Deionized, distilled.

3.3 Analysis.

3.3.1 Fuming sulfuric acid—15 to 18% by weight free sulfur trioxide.

3.3.2 Phenol—White solid reagent grade.

3.3.3 Sulfuric acid—Concentrated reagent grade.

3.3.4 Standard solution—Dissolve 0.5495 g. potassium nitrate (KNO_3) in distilled water and dilute to 1 liter. For the working standard solution, dilute 10 ml. of the resulting solution to 100 ml. with distilled water. One ml. of the working standard solution is equivalent to 25 µg. nitrogen dioxide.

3.3.5 Water—Deionized, distilled.

3.3.6 Phenoldisulfonic acid solution—Dissolve 25 g. of pure white phenol in 150 ml. concentrated sulfuric acid on a steam bath. Cool, add 75 ml. fuming sulfuric acid, and heat at 100° C. for 2 hours. Store in a dark, stoppered bottle.

4. *Procedure.*

4.1 Sampling.

4.1.1 Pipette 25 ml. of absorbing solution into a sample flask. Insert the flask valve stopper into the flask with the valve in the "purge" position. Assemble the sampling train as shown in Figure 7-1 and place the probe at the sampling point. Turn the flask valve and the pump valve to their "evacuate" positions. Evacuate the flask to at least 3 inches Hg absolute pressure. Turn the pump

(Phenoldisulfonic Acid Procedure). In: 1968 Book of ASTM Standards, Part 23, Philadelphia, Pa. 1968, ASTM Designation D-1608-60, p. 725-729.

Jacob, M. B., The Chemical Analysis of Air Pollutants, New York, N.Y., Interscience Publishers, Inc., 1960, vol. 10, p. 351-356.

METHOD 8—DETERMINATION OF SULFURIC ACID MIST AND SULFUR DIOXIDE EMISSIONS FROM STATIONARY SOURCES

1. *Principle and applicability.*

1.1 Principle. A gas sample is extracted from a sampling point in the stack and the acid mist including sulfur trioxide is separated from sulfur dioxide. Both fractions are measured separately by the barium-thorin titration method.

1.2 Applicability. This method is applicable to determination of sulfuric acid mist (including sulfur trioxide) and sulfur dioxide from stationary sources only when specified by the test procedures for determining compliance with the New Source Performance Standards.

2. *Apparatus*

2.1 Sampling. See Figure 8-1. Many of the design specifications of this sampling train are described in APTD-0581.

2.1.1 Nozzle—Stainless steel (316) with sharp, tapered leading edge.

2.1.2 Probe—Pyrex[1] glass with a heating system to prevent visible condensation during sampling.

2.1.3 Pitot tube—Type S, or equivalent, attached to probe to monitor stack gas velocity.

2.1.4 Filter holder—Pyrex[1] glass.

2.1.5 Impingers—Four as shown in Figure 8-1. The first and third are of the Greenburg-Smith design with standard tip. The second and fourth are of the Greenburg-Smith design, modified by replacing the standard tip with a ¼ inch ID glass tube extending to one-half inch from the bottom of the impinger flask. Similar collection systems, which have been approved by the Administrator, may be used.

2.1.6 Metering system—Vacuum gauge, leak-free pump, thermometers capable of measuring temperature to within 5° F, dry gas meter with 2% accuracy, and related equipment, or equivalent, as required to maintain an isokinetic sampling rate and to determine sample volume.

2.1.7 Barometer—To measure atmospheric pressure to ±0.1 inch Hg.

[1] Trade name.

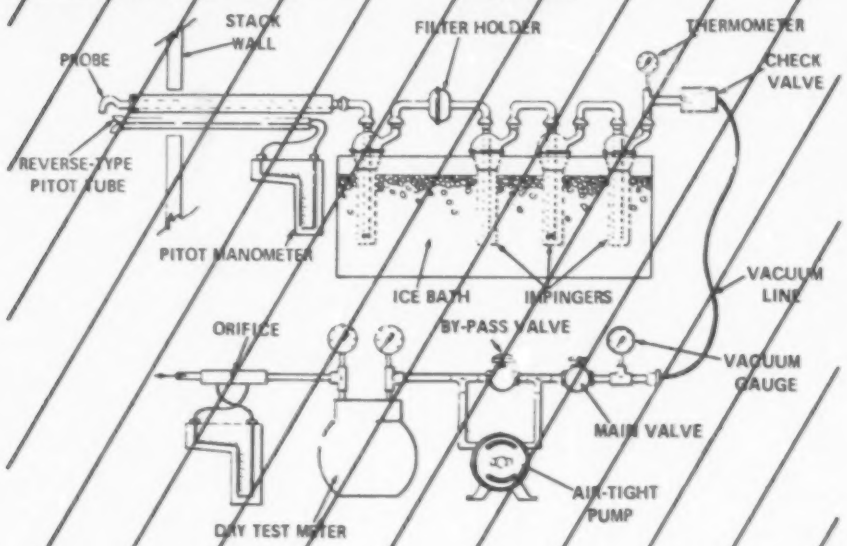


Figure 8-1. Sulfuric acid mist sampling train.

APPENDIX D

FIELD DATA LOG FOR DUPONT 411 PHOTOMETRIC ANALYZER

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/4/75 Zero Gas <0.1 ppm Cylinder Pressure 1500

Instrument Ser. No. 0142 Zero Gas 3980 ppm NO_2 Cylinder Pressure 700

Location Hercules, Bessemer Ala Inlet Oxygen Cylinder Pressure 2500

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1230	E_1	220	C 1000 F 500					Test 50
	E_2	"	"					Test 45
	M light	"	"					Test 12
	R light	"	"					
	M dark	"	"					
	R dark	"	"					
	M-R	250	C 834 F 500		025			
1500	Zero	222	C 850 F 500	400	000			
1505	3980 ppm span	"	"	400	3960 to 4000			cell temp 115° F
1715	Zero	"	C 850 F 502	400				adjust fine zero
	3980 span	"	"	400	3980	79.5		adjust recorder span
1730	Sample	"	"	400	500			Leave on overnight
c								

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/5/75

Instrument Ser. No. 0142

Location Hercules Bessemer Ala Inlet

Zero Gas < 0.1 ppm NO_x Cylinder Pressure 1500

Span Gas 3980 ppm NO_2 Cylinder Pressure 690

Oxygen 2 Cylinder Pressure 2300

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
0830	Sample	222	C850 F502	200	2700			Analyzer Operated During Night
0845	Zero	"	"	500	140			
0855	Zero	"	C850 F484	500	000			adjust fine zero
0905	Span	"	"	500	4000	80		cell temp 113 °C
0915	Sample	"	"	400	Aprox 1700			5000 ppm full scale
0945	NO_x	"	"	0	1900			
0950	Sample	"	"	400				POS NO_x Sample. Water in line
1000	No Sample	"	"	0				Change sample, shut off flow line, dry trap
1115	Zero	"	"	400	-018			
1125	Zero	"	C850 F512					
1135		"	"	0				Plant Shut Down
1215	Zero	"	"	400	+060			
1225	Zero	"	C850 F515	400	000	20		adjust zero
1226	Sample	"	"	400	approx 1600			change range from 20 mv to 50 mv
1245	NO_x	"	"	0	1850			cell temp 116 °F

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NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/5/75 Zero Gas <0.1 ppm NO_x Cylinder Pressure 1500

Instrument Ser. No. C142 ~~Zero~~ Span Gas 3980 ppm NO_2 Cylinder Pressure 700

Location Hercules, Bessemer Ala ~~Sample~~ Inlet Oxygen _____ Cylinder Pressure 2300

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1255	Sample	222	C 850 F 515	400	1400 to 1300			
1315	NO_x	"	"	0	1970			PDS Sample 1315
1320	Sample	"	"	400	1300			
1330	NO_x	"	"	0	1970			
1335	Sample	"	"	400	1340			
1345	NO_x	"	"	0	2030			PDS Sample 1345 cell temp 118°F
1350	Sample	"	"	400	1350			
1400	NO_x	"	"	0	2010			
1405	Sample	"	"	400	1340			Servo on 1412
1415	NO_x	"	"	0	2100			PDS Sample 1415
1420	Sample	"	"	400	1340			
1430	NO_x	"	"	0	2050			
1435	Sample	"	"	400	1290			
1445	NO_x	"	"	0	1970			PDS Sample 1445 cell temp 121°F
1450	Sample	"	"	400	1350 1700			

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NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/5/75

Instrument Ser. No. 0142

Location Hercules, Bessemer Ala ~~Sample~~ Inlet

Zero Gas _____ Cylinder Pressure _____

Zero Gas _____ Cylinder Pressure _____

Oxygen _____ Cylinder Pressure _____

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1500	zero	222	C85C F515	400	-010	20		
1504	Zero ~~Sample~~	"	C85C F517	400	000	20		adjust fine zero
1505	Sample ~~NO_x~~	"	"	400	1740			
1508	NO_x	"	"	0	2800			
1512	Sample	"	"	400	1650			
1516	NO_x	"	"	0	2550			PDS sample 1516
1520	Sample	"	"	400	1730			
1530	NO_x	"	"	0	1660			
1535	Sample	"	"	400	1780			
1545	NO_x	"	"	0	2590			cell temp 121°F PDS sample 1545
1550	Sample	"	"	400	1780			
1600	NO_x	"	"	0	2680			
1605	Sample	"	"	400	1770			
1615	NO_x	"	"	0	2610			
1620	Sample	"	"	400	1750			

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/5/75

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TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1630	NO_x	222	C850 F517	0	2600			
1635	Sample	"	"	400	2000			
1645	NO_x	"	"	0	2910			PDS Sample 1645 cell temp 122°F
1650	Sample	"	"	400	2000 to 1850			
1700	NO_x	"	"	0	2750			
1707	Sample	"	"	400	1750			
1715	NO_x	"	"	0	2610			
1720	Sample	"	"	400	1750			
1730	NO_x	"	"	0	2620			
1735	Sample	"	"	400	1770			
1745	NO_x	"	"	0	2680			PDS Sample 1745 cell temp 120°F
1752	Sample	"	"	400	1820			
1800	NO_x	"	"	0	2650			
1805	Zero	"	"	600	000	20		
1820	3960 ppm Span	"	"	400	3960 4020	995		cell temp 118°F

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/5/75

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TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1830	Sample	222	C 850 F 517					

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/6/75

Instrument Ser. No. 0142

Location Hercules, Bessemer Ala Inlet

Zero Gas <0.1 ppm NO_x Cylinder Pressure 1475

Span ~~Zero~~ Gas 3980 ppm NO_2 Cylinder Pressure 675

Oxygen _____ Cylinder Pressure 2350

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
0825	Sample	222	C850 F517	300	1380			Instrument Operated During Night. Recorder OK
0830	Sample	"	"	"	1380			Cell Temp 115°F Set clear at 0830 120 mm/hr
0833	Zero	"	"	400	020	20.5%		
0837	Zero	"	C850 F513	400	000	20.		adjust fine zero
0850	Zero	"	"	400	030			
0851	Zero	"	C850 F510	400	000	20		adjust fine zero
0855	3980 ppm Span	"	"	400	3950	98.5		
0900	"	"	"	400	3950	99.		adjust Recorder to 99
0903	Sample	"	"	400	1500 to 1680			
0915	NO_x	"	"	0	2280			
0920	Sample	"	"	400	1590			
0930	NO_x	"	"	0	2310			
0935	Sample	"	"	400	1680			
0945	NO_x	"	"	0	2450			
0950	Sample	"	"	400	1750 to 1700			

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/6/75

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TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1000	NO_x	222	C850 F510	0	2410			
1005	Sample	"	"	400	1730 to 1660			
1015	NO_x	"	"	0	2430			PDS Sample 1015
1020	Sample	"	"	400	1810			
1030	NO_x	"	"	0	2700			cell temp 117°F
1035	Sample	"	"	400	1910 to 1980			
1095	NO_x	"	"	0	2760			
1050	Sample	"	"	400	2000 to 2180			
1100	NO_x	"	"	0	3000			
1105	Sample	"	"	400	2120 to 2220			
1115	NO_x	"	"	0	3190			PDS Sample 1115
1120	Sample	"	"	400	2300 to 2310			
1130	NO_x	"	"	0	3360			
1135	Sample	"	"	400	2400 to 2460			
1145	NO_x	"	"	0	3400			

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/6/75

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TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1150	Sample	222	C850 F510	400	2410 2320 to			
1200	NO_x	"	"	0	3230			
1205	Sample	"	"	400	2230 2190			
1215	NO_x	"	"	0	3120			PDS Sample 1215
1220	zero ~~Sample~~	"	"	400	000			
1225	Sample	"	"	400	2340 2370 to			
1230	NO_x	"	"	0	3370			cell temp 119° F
1235	Sample	"	"	400	2320 2300 to			
1245	NO_x	"	"	0	3300			
1250	Sample	"	"	400	2360 2280 to			
1300	NO_x	"	"	0	3330			
1305	Sample	"	"	400	2290 2390 to			
1315	NO_x	"	"	0	3440			PDS Sample 1316
1320	Sample	"	"	400	2280 2150 to			
1330	NO_x	"	"	0	2475			

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/6/75

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TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1335	Sample	222	C 850 F 510	400	2120 to 2100			
1345	NO_x	"	"	0	2920			
1350	Sample	"	"	400	2180 to 2230			
1400	NO_x	"	"	0	3110			
1405	Sample	"	"	400	2150 to 2070			
1415	NO_x	"	"	0	2870			PDS Sample 1415
1420	Sample	"	"	400	2040 2000 to			
1430	NO_x	"	"	0	2770			cell temp 122°F
1435	Sample	"	"	400	2000			
1445	NO_x	"	"	0	2750			
1450	Sample	"	"	400	1970 2040 to			
1500	NO_x ~~Sample~~	"	"	0	2890			
1505	Sample	"	"	400	2200 2390 to			
1515	NO_x	"	"	0	3270			PDS Sample 1515
1520	Sample	"	"	400	2470 2550 to			

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/6/75

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TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1530	NOx	222	C850 F510	0	3460			
1535	Sample	"	"	400	2560 to 2470			
1545	NOx	"	"	0	3290			
1550	Sample	"	"	400	2500 to 2530			
1600	NOx	"	"	0	3370			
1605	Sample	"	"	400	2450 to 2440			
1616	NOx	"	"	0	3300			PDS · Sample 1616
1620	Sample	"	"	400	2380 to 2290			
1632	NOx	"	"	0	3070			
1636	Sample	"	"	400	2250 to 2220			
1645	NOx	"	"	0	3000			
1650	Sample	"	"	400	2220 to 2180			cell temp 126°F
1700	NOx	"	"	0	2940			
1706	Sample	"	"	400	2150 to 1770			
1715	NOx	"	"	0	2320			PDS Sample 1715

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/6/75

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TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1720	Sample	222	C850 F510	400	1400 1460			Upset condition
1730	NOx	"	"	0	1770			"
1735	Sample	"	"	400	1275 0610			"
1745	NOx	"	"	0	1070			"
1750	Sample	"	"	400	1100 1420			"
1800	NOx	"	"	0	2120			cell temp 122
1828	Zero ~~Sample~~	"	"	400	-110	17.75		
1836	Zero	"	C850 F524	400	000	20		adjust fine zero
1843	3980 Span	"	"	400	3950	99		cell temp 120°F
1850	Sample	"	"	400				

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/7/75

Instrument Ser. No. 0142

Location Hercules, Bessemer, Ala Inlet

Zero Gas <0.1 ppm NO_x Cylinder Pressure 1450

~~Zero~~ Span Gas 3980 ppm NO_2 Cylinder Pressure 700

~~Oxygen~~ Cylinder Pressure 2350

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
0840	Sample	222	C850 F524	550	1700			Instrument Operated During Night, Recorder OK
0850	Zero	"	"	400	060	21 +		Increase Recorder Chart Speed to 120 mm/hr
0900	Zero	"	C850 F518	400	000	20		Adjust fine zero
0903	3980 ppm Span	"	"	400	4000	99.5		cell temp 116 °F
0910	Sample	"	"	400	1670			
0915	NO_x	"	"	0	2800			PDS Sample 0915
0920	Sample	"	"	400	1550 1470			
0930	NO_x	"	"	0	2440			
0935	Sample	"	"	400	1510 1550			
0945	NO_x	"	"	0	2710			
0950	Sample	"	"	400	1630 1790			
1000	NO_x	"	"	0	3020			
1005	Sample	"	"	400	1600 to 1110			
1015	NO_x	"	"	0	1620			PDS Sample 1015
1020	Sample	"	"	400	1220 to 940			

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER.

(Continued)

DATE 3/7/75

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TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1030	NO_x	222	C 850 F 518	0	1360			
1035	Sample	11	11	400	1500 2080			
1045	NO_x	11	11	0	3900			
1051	Sample	11	11	400	2210 2240			
1100	NO_x	11	11	0	4060			attenuate to 100mv range on recorder for NO_x reading
1106	Sample	11	11	400	2290 2310 to			place recorder back on ~~mv~~ 50mv range
1115	NO_x	11	11	0	4150			PDS Sample 1115 / attenuate to 100mv range on recorder
1120	Sample	11	11	400	2340 2350 to			place recorder back on 50mv range
1130	NO_x	11	11	0	4000			~~attenuate to 100mv range on recorder~~ not necessary
1135	Sample	11	11	400	2200 2060 to			
1145	NO_x	11	11	0	3400			
1150	Sample	11	11	400	2110 2170 to			
1200	NO_x	11	11	0	3690			
1205	Sample	11	11	400	2240 2340 to			
1215	NO_x	11	11	0	3940			PDS Sample 1215

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/7/75

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TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1220	Sample	222	C850 F518	400	2310 to 2140			
1230	NO_x	"	"	0	3330			cell temp 116°F
1236	Sample	"	"	400	2140 to 2100			
1245	NO_x	"	"	0	3300			
1250	Sample	"	"	400	2120 to 2160			
1300	NO_x	"	"	0	3350			
1305	Sample	"	"	400				change chart paper
1310	"	"	"	400	2150 to 1810			New chart paper
1315	NO_x	"	"	0	2490			PDS Sample 1315
1320	Zero ~~Sample~~	"	"	400	050	21		
1325	zero	"	C850 F514	400	000	20		adjust fine zero
1330	sample	"	"	400	1490 to 1530			cell temp 118°F
1345	NO_x	"	"	0	2090			
1350	Sample	"	"	400	1560 to 1550			
1400	NO_x	"	"	0	280			

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/7/75

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TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1405	Sample	222	C850 F514	400	1490 1470 to			
1415	NOx	"	"	0	2040			PDS Sample 1415
1420	Sample	"	"	400	1550 1600 to			
1430	NOx	"	"	0	2240			
1435	Sample	"	"	400	1680 1700 to			cell temp 120°F
1445	NOx	"	"	0	2300			
1450	Sample	"	"	400	1700 1660 to			
1500	NOx	"	"	0	2240			
1505	Sample	"	"	400	1650 1650 to			
1515	NOx	"	"	0	2210			PDS Sample 1515
1520	Sample	"	"	400	1650 1650 to			
1530	NOx	"	"	0	2190			
1535	Sample	"	"	400	1590 1570			cell temp 126°F
1545	NOx	"	"	0	2120			
1552	Sample	"	"	400	1470 1400 to			

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/7/75

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TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1600	NOx	222	C850 F514	0	1890			
1605	Sample	"	"	400	1500 to 1560			
1615	NOx	"	"	0	2240			PDS Sample 1615
1623	Sample	"	"	400	1570 to 1580			
1630	NOx	"	"	0	2140			
1635	Sample	"	"	400	1600 to 1590			
1645	NOx	"	"	0	2190			
1650	Sample	"	"	400	1630 to 1630			
1700	NOx	"	"	0	2200			PDS NOx Sample [redacted] 1658
1705	Zero	"	"	400	-080	18.2		
1710	Zero	"	C850 F528	"	000	20		adjust fine zero
1715	3980 Span	"	C850 F528	400	3980 to 4000	99.2 to 99.8		cell temp 120

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/10/75

Instrument Ser. No. 0142

Location Hercules, Bessemer Ala Inlet

Zero Gas <0.1 ppm NO_x Cylinder Pressure 1350

~~Zero~~ Span Gas 3980 ppm NO_2 Cylinder Pressure 630

~~Oxygen~~ 2 Cylinder Pressure 2250

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
0830	Zero	222	C850 F528	400	030	26		
0835	Zero	"	C850 F486	400	000	20		adjust fine zero
0845	Span	"	"	"	4000	100		cell temp 110° F
0855	Zero	"	"	100	[illegible]0	decreasing		
1355	Zero	"	"	400	-170	17.25		cell temp 120° F
1400	Zero	"	C850 F505	400	000	20		adjust fine zero
1415	"	"	"	"	"			Change light source
1430	Zero	"	C850 F550	400	000	30		adjust fine zero
1440	Span	"	"	400	3960	99.5		adjust to 99.5 cell temp 115

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/11/75

Instrument Ser. No. 0142

Location Hercules, Bessemer Ala Inlet

Zero Gas 40.1 ppm NO_x Cylinder Pressure 1310

~~Zero~~ Span Gas 3980 ppm NO_2 Cylinder Pressure 650

Oxygen _____ Cylinder Pressure 2310

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
0805	Zero	222	C850 F550	400	-40	19		
0820	Zero	"	C850 F556	400	000	20		adjust fine zero
0825	"	"	"	025	000	20		
1300	"	"	"	400	-100	17.8		
1320	"	"	C850 F571	400	000	20		adjust fine zero
1325	Span	"	"	400	3980	99.75		cell temp [redacted] 115 °F
1350	Zero	"	"	400	000	20		
1355	Sample	"	"	400	675 to 600			
1415	NO_x	"	"	0	1060			PDS Sample 1415
1420	Sample	"	"	400	510 to 480			
1430	NO_x	"	"	0	760			
1435	Sample	"	"	400	470 to 480			
1445	NO_x	"	"	0	730			PDS Sample 1445
1450	Sample	"	"	400	490 to 500			
1500	NO_x	"	"	0	760			

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/11/75

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TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1505	Sample	222	C850 F571	400	510 to 540			
1515	NOx	"	"	0	760			PDS Sample 1515
1520	Sample	"	"	400	470 to 560			
1530	NOx	"	"	0	870			
1535	Sample	"	"	400	630 to 680			
1545	NOx	"	"	0	1060			PDS Sample 1545
1550	Sample	"	"	400	720 to 850			
1600	NOx	"	"	0	1280			
1605	Sample	"	"	400	880 to 910			
1615	NOx	"	"	0	1340			PDS Sample 1615
1620	Sample	"	"	400	900 to 880			
1630	NOx	"	"	0	1290			
1635	Sample	"	"	400	870 to 870			
1645	NOx	"	"	0	1280			PDS Sample 1645
1450	Sample	"	"	400	0850 to 0850			

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/11/75

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TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1700	NO_x	222	C850 F571	0	1240			~~PDS Sample~~
1705	Sample	"	"	400	0840 0850 to			
1715	NO_x	"	"	0	1260			PDS Sample 1715
1720	Sample	"	"	400	0860 0870 to			
1730	NO_x	"	"	0	1270			
1735	Sample	"	"	400	0860 0860 to			
1745	NO_x	"	"	0	1250			PDS Sample 1745
1750	Sample	"	"	400	760			
1755	Zero	"	"	400	0130	22.8		
1755	Zero	"	C850 F553	400	000	20		
1804	3980 Span	"	"	400	3930	99		cell temp 120°F
1810	Sample	"	"	400				

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/12/75

Instrument Ser. No. 0142

Location Hercules, Bessemer Ala Inlet

Zero Gas <0.1 ppm Cylinder Pressure 1300

~~Zero~~ Span Gas 3980 ppm Cylinder Pressure 600

Oxygen _____ Cylinder Pressure 2300

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
0810	Sample	222	C850 F553	400	760			
0815	Zero	"	"	"	-190	15.9		
0825	"	"	"	"	000	20		adjust fine zero
0840	Span	"	"	400	3890	98		cell temp 125°C
0850	"	"	"	400	3890	98		adjust recorder span
0855	"	"	"	400	3900	98		equivalent to 3970 ppm at 115°
0856	Zero	"	[redacted] "	400	-030	19.2		~~adjust fine zero~~
0900	Zero	"	C850 F582	400	000	20		adjust fine zero
0903	Span	"	"	400	3950	99.0		cell temp 120°C
0910	Zero	"	"	400	020	20.5		
0920	Zero	"	C850 F578	400	000	20		adjust fine zero
0925	Span	"	"	400	3930	98.7		cell temp 120°
0930	Sample	"	"		1480 to 1550			
1022	NO_2	"	"	0	2110			PDS sample 1023
1027	Sample	"	"	400	1470 1550			

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER.

(Continued)

DATE 3/12/75

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TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1045	NO_x	222	C850 F578	0	2170			
1050	Sample	"	"	400	1550 1620 to			
1100	NO_x	"	"	0	2260			
1105	Sample	"	"	400	1700 1890 to			
1120	NO_x	"	"	0	2660			PDS Sample 1120
1125	Sample	"	"	400	1970 1950 to			cell temp 122 °F
1130	NO_x	"	"	0	2720			
1135	Sample	"	"	400	1990 to 2000			
1145	NO_x	"	"	0	2760			
1150	Sample	"	"	400	1870 1810 to			
1200	NO_x	"	"	0	2490			
1205	Sample	"	"	400	1740 1660 to			
1215	NO_x	"	"	0	2290			PDS Sample 1215
1220	Sample	"	"	400	1700 1670 to			cell temp 124 °F
1230	NO_x	"	"	0	2290			

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/12/75

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TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1235	Sample	222	C850 F578	400	1650 to 1640			cell temp 126°F
1245	NOx	"	"	0	2270			
1251	Sample	"	"	400	1650 to 1690			
1300	NOx	"	"	0	2360			
1305	Sample	"	"	400	1730 to 1660			
1316	NOx	"	"	0	2290			
1321	Sample	"	"	400	1600 to 1580			P.D.S Sample 1316
1330	NOx	"	"	0	2200			
1335	Sample	"	"	400	1590 to 1570			cell temp 122°F
1345	NOx	"	"	0	2180			increased production rate
1350	Sample	"	"	400	1650 to 1970			
1400	NOx	"	"	0	2240			
1405	Sample	"	"	400	1970 to 1930			
1415	zero	"	"	400	000	20		
1420	Sample	"	"	400	1800 to 1760			

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/12/75

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TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1430	NO_x	222	C850 F578	0	2380			PDS Sample 1430
1435	Sample	"	"	400	1650 1670 to			cell temp 120°F
1445	NO_x	"	"	0	2350			
1450	Sample	"	"	400	1720 1720 to			
1500	NO_x	"	"	0	2380			
1505	Sample	"	"	400	1690 1670 to			
1516	NO_x	"	"	0	2300			PDS Sample 1516
1521	Sample	"	"	400	1700 1730 to			
1530	NO_x	"	"	0	2380			
1535	Sample	"	"	400	1760 1790 to			cell temp 120°F
1545	NO_x	"	"	0	2450			
1550	Sample	"	"	400	1800 1850 to			
1600	NO_x	"	"	0	2540			
1605	Sample	"	"	400	1860			
1615	NO_x	"	"	0	2530			PDS Sample 1615

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/12/75

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TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1620	Sample	222	C850 F578	400	1850 1650 to			
1630	NO_x	"	"	0	2200			cell temp 121°F
1635	Sample	"	"	400	1570 1560 to			
1645	NO_x	"	"	0	2090			
1650	Sample	"	"	400	1550 1540			
1700	NO_x	"	"	0	2080			
1705	Sample	"	"	400	1550 1520 to			
1715	NO_x	"	"	0	2080			
1721	Sample	"	"	400	1500 1560 to			
1730	NO_x	"	"	0	2240			
1735	Sample	"	"	400	1750 1820 to			cell temp 123°F
1745	NO_x	"	"	0	2640			PDS Sample 1745
1750	Sample	"	"	400	1800 1530 to			
1800	NO_x	"	"	0	2200			
1805	Sample	"	"	400	1640 1720 to			

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/12/75

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TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1810	zero	222	C850 F578	400	050	21		
1830	zero	222	C850 F572	400	000	20		adjust fine zero
1833	Span	11	11	400	3950			cell temp. [illegible]
1845	Sample							change Port to HV23
								Inlet to Demister

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/13/75

Instrument Ser. No. 0142

Location Hercules Bessemer Ala
HV-23 Inlet to Demister

Zero Gas <0.1 ppm NO_x Cylinder Pressure 1200

~~Zero~~ Span Gas 3960 ppm NO_2 Cylinder Pressure

Oxygen Cylinder Pressure

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
0815	Sample	222	C850 F572	300	2440			cell temp 110° F
0816	zero	"	"	400	320	26		
0830	zero	"	C850 F530	000	000	20		adjust fine zero
0845	Span	"	"	400	3970	99		cell temp 113° F
0900	zero	"	"	400	000	20		
0915	zero	"	"	400	-010	19.8		
0930	zero	"	C850 F531	400	000	20		adjust fine zero
0940	Sample	"	"	400	1400 to 1260			
1017	Sample	"	"	400	1260 to 1270			sieve switched 1017
1030	NO_x	"	"	0	1910			
1035	Sample	"	"	400	1250 to 1200			
1045	NO_x	"	"	0	1810			bypass opened 1040 PDS sample 1045
1050	Sample	"	"	400	1250 to 1160			
1100	NO_x	"	"	0	1770			
1105	Sample	"	"	400	1320 to 1450			

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/13/75

Page 2 of 0142 HV-23 Inlet to Demister

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1115	NO_x	222	C850 F531	0	2060			
1120	Sample	"	"	400	1420 1360 to			
1130	NO_x	"	"	0	1850			PDS Sample 1130
1135	Sample	"	"	400	1230 1000 +			
1145	NO_x	"	"	0	1440			
1150	Sample	"	"	400	1380 1210 to			
1200	NO_x	"	"	0	2940			
1205	Sample	"	"	400	1850 1810 to			
1217	NO_x	"	"	0	3040			PDS Sample 1217
1222	Sample	"	"	400	1970 2100 to			cell temp 114°F
1230	NO_x	"	"	0	3370			
1235	Zero	"	"	400	040	20.9		
1238	Zero	"	C850 F527	400	000	20		adjust fine zero
1240	Sample	"	"	400	2250 2260 to			
1245	NO_x	"	"	0	3420			

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER.

(Continued)

DATE 3/13/75

Page 3 of 0142 HV-23 Inlet to Demister

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1250	Sample	222	C850 F527	400	2380 to 2470			
1300	NOx	"	"	0	3800			
1305	Sample	"	"	400	2510 to 2590			
1315	NOx	"	"	0	3850			
1320	Sample	"	"	400	2640 to			
1330	NOx	"	"	0	4030			switch recorder to 100 mv scale for NOx reading
1335	Sample	"	"	400	2690 to 2790			cell temp 117°F
1345	NOx	"	"	0	3930			
1350	Sample	"	"	400	2500 to			
~~1400~~	~~NOx~~	~~"~~	~~"~~	~~0~~				1357 Sundyne shut off and turned on. Bypass valve opened.
1415	NOx	"	"	0	3570			
1420	Sample	"	"	400	2570 to 1120			cell temp 119°F
1500	NOx	"	"	0	2090			
1505	Sample	"	"	400	1150 to 1970			
1515	NOx	"	"	0	3020			

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/13/75

Page 4 of C142 HV-23 Inlet to Demister

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1520	Sample	222	C850 F527	400	1840 to 1860			
1530	NO_x	"	"	0	2890			PDS sample 1530
1535	Sample	"	"	400	1730			cell temp 121°F
1545	NO_x	"	"	0	2770			
1550	Sample	"	"	400	1840 1790 to			
1600	NO_x	"	"	0	2810			
1605	Sample	"	"	400	1820 1930 to			
1615	NO_x	"	"	0	3020			
1620	Sample	"	"	400	1800 1920 to			
1630	NO_x	"	"	0	2860			
1635	Sample	"	"	400	1800 1690 to			cell temp 121°F
1645	NO_x	"	"	0	2830			
1650	Sample	"	"	400	1760 1530 to			
1700	NO_x	"	"	0	3040			
1705	Sample	"	"	400	1840 1890 to			

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/13/75

Page 5 of 0142 HV-23 Demister Inlet

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1715	NO_x	222	C850 F527	0	3050			
1720	Sample	"	"	400	1950 1850 to			
1730	NO_x	"	"	0	2930			
1735	Sample	"	"	400	1850 1920 to			cell temp 121°F
1745	NO_x	"	"	0	3060			
1750	Sample	"	"	400	1860 1900 to			
1800	NO_x	"	"	0	3040			
1805	Sample	"	"	400	1980 2010 to			
1815	NO_x	"	"	0	3210			
1820	Sample	"	"	400	2050 2090 to			
1830	NO_x	"	"	0	3320			
1835	Sample	"	"	400	2150 2240 to			
1848	NO_x	"	"	0	3440			cell temp 120°F
1853	Sample	"	"	400	2210 2290 to			
1900	NO_x	"	"	0	3420			

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/13/75

Page 6 of 0142 HV-23 Demister ~~Outlet~~ Inlet

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1905	zero	222	C850 F527	400	-180	16		
1910	"	"	C850 F550	400	000	20		adjust fine zero
1913	Span	"	"	400	3920	98.25		cell temp 120°F
1920	Sample	"	"	400				

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/14/75 Zero Gas <.01 ppm NO_x Cylinder Pressure 1150

Instrument Ser. No. 0142 Zero Gas 398 ppm NO_2 Cylinder Pressure 550

Location Hercules, Bessemer Ala. Oxygen _____ Cylinder Pressure 2200

HV-23 Inlet to Demister

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
0630	Sample	222	C850 F550	400				
0635	Zero	"	"	"	018	23.7		
0642	Zero	"	C850 F527	"	000	20		adjust fine zero
0645	Span	"	"	400	4040	slightly >100		cell temp 107°C
0651	Sample	"	"	400	1960 to 2180			sieve switched to A on absorb 0711
0711	Sample	"	"	400	2180 to 2200			
0715	NO_x	"	"	0	3400			
0720	Sample	"	"	400	2100 to 2120			
0730	NO_x	"	"	0	3410			
0735	Sample	"	"	400	2180 to 2180			
0745	NO_x	"	"	0	3320			FDS Sample 0745
0750	Sample	"	"	400	2210 to 2220			
0800	NO_x	"	"	0	3290			
0805	Sample	"	"	400	2210 to 2170			
0815	NO_x	"	"	0	3190			

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER.

(Continued)

DATE 3/14/75

Page 2 of 0142 14V-23 Inlet to Demister

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
0820	Sample	222	C850 F527	400	2150 to 2150			
0830	NO_x	"	"	0	3180			
0835	Sample	"	"	400	2160 to 2140			
0845	NO_x	"	"	0	3170			0845 PDS Sample 110 °F cell temp
0850	Sample	"	"	400	2140 2140 to			
0900	NO_x	"	"	0	3160			
0905	zero	"	"	400	050	21		
0910	zero	"	C850 F520	"	000	20		adjust fine zero
0915	Sample	"	"	400	2075 2010 to			
0930	NO_x	"	"	0	3090			
0935	Sample	"	"	400	2030 to 2010			
0945	NO_x	"	"	0	3090			PDS Sample 0945. cell temp 108 °F
0950	Sample	"	"	400	1930 to 1990			
1000	NO_x	"	"	0	3070			
1005	Sample	"	"	400	1970 to 2030			

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/14/75

Page 3 of 0142 HV-23 Inlet to Demister

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1015	NO_x	222	C850 F520	0	3050			
1020	Sample	"	"	400	2030 2018 to			
1030	NO_x	"	"	0	3000			
1035	Sample	"	"	400	1990 1970 to			
1045	NO_x	"	"	0	2980			PDS Sample 1045 cell temp 107°F
1050	Sample	"	"	400	1970 to 1960			
1100	NO_x	"	"	0	2960			
1105	Sample	"	"	400	1960 1920 to			
1115	Zero	"	"	400	000			
1122	Span	"	"	400	4030	100 +		cell temp 108°F

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/4/75

Instrument Ser. No. 0166

Location Hercules, Bessemer Ala Outlet

Zero Gas <0.1 ppm NO_x Cylinder Pressure 1500

~~Zero~~ Span Gas 35 ppm NO_2 Cylinder Pressure 2100

Oxygen _____ Cylinder Pressure 2500

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1145	E_1	795	C 1000 F 500					Test 49.5
	E_2	"	"					Test 47.
	M light	"	"					Test 21.
	R light	"	"					Test 17.5
	M dark	"	"					Test 35.
	R dark	"	"					Test 33
~~1215~~	~~Zero~~							
	M-R	250	C 806 F 500		025			Screen In 023
1215	Zero	795	C 800 F 496	400	000			adjust to 000. Cal Filter in, Meter 470
1230	Span	795	"	400	032			
1430	Span	795	"	400	032			
1445	Zero	795	"	400	000			
1450	Zero	795	C 800 F 490	400	000			Adjust fine zero
1510	3980 ppm Span	795	C 800 F 490	400	4000 to 3960	79-80		cell temp 108°F
1700	Zero	"	"	400	000			zero stabil

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/4/75

Instrument Ser. No. 0166

Location Hercules, Bessemer Ala Outlet

Zero Gas < 0.1 ppm NO_2 Cylinder Pressure 1500

Span ~~Zero~~ Gas 3.5 ppm NO_2 Cylinder Pressure 2100

Oxygen _____ Cylinder Pressure 2500

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1730	Sample	795	CECC F49C	400	800			Sample, recorder 1000 ppm full scale
0830	Sample	795	CECC F49C	400	100			see new sheet for 3/4/75

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/5/75

Instrument Ser. No. 0166

Location Hercules, Bessemer Ala Outlet

Zero Gas <0.1 ppm NO_x Cylinder Pressure 1500

Span ~~Zero Gas~~ 35 ppm NO_2 Cylinder Pressure 1800

Oxygen _____ Cylinder Pressure 2300

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
0830	Sample	795	C 800 F 490	400	100			Instrument Operated During Night.
0845	Zero	"	"	300	050			
0855	Zero	795	C 800 F 474	300	000			adjust fine zero cal filter in Meter 471
0905	~~200 ppm~~ Span	"	"	500	035			cell temp 108°F
0915	Zero	"	"	500	000			
0920	Span	795	"	500	30			
0925	Sample	795	"	500	Aprox 20-25			100 ppm Full scale
0950	NO_x	795	"	0	029			
0955	Sample	795	"	500				
1045	Zero	795	"	500	-048			
1050	Zero	795	C 803 F 474	500	000	50		Set zero at 50% of chart
1100	Zero	795	C 803 F 477	500	000	50		adjust fine zero
1110	Sample	795	"	500	65-70			
1135		"	"	0				Plant Shut Down
1215	Zero	795	"	500	005			

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NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/5/75

Instrument Ser. No. 0166

Location Hercules, Bessemer Ala Outlet

Zero Gas < 0.1 ppm NO_x Cylinder Pressure 1500

Span ~~Zero Gas~~ 35 ppm NO_2 Cylinder Pressure 1900

Oxygen _____ Cylinder Pressure _____

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1220	Zero	795	C 3 F 473		000	50		adjust zero
1235	Sample	"	"	400	100			
1245	NOx	"	"	0	100			PDS Sample 1258
1255	Sample	"	"	400	98 to 113			cell temp 109°F
1320	NOx	"	"	0	113			PDS Sample 1320
1325	Sample	"	"	400	135			
1335	NOx	"	"	0	135			
1340	Zero	"	"	400	000			
1343	Sample	"	"	400	154			
1350	NOx	"	"	0	154			PDS Sample 1350 cell temp 110°F
1355	Sample	"	"	400	166			
1405	NOx	"	"	0	166			
1410	Sample	"	"	400	166 to 85			sieve on B 1412
1420	NOx	"	"	0	85			PDS Sample 1420
1425	Sample	"	"	400	114 to 90			

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NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/5/75

Instrument Ser. No. 0166

Location Hercules, Bessemer Ala Outlet

Zero Gas <0.1 ppm NO_x Cylinder Pressure 1500

~~Zero~~ Span Gas 35 ppm NO_2 Cylinder Pressure 1900

Oxygen _____ Cylinder Pressure _____

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1435	NOx	795	C803 F473	0	085			
1440	Sample	"	"	400	073			
1445	Zero	"	"	400	007			cell temp 110
1448	Zero	"	C803 F469	400	000	50		adjust fine zero
1450	Sample	"	"	400	065			
1454	NOx	"	"	0	066			PDS Sample 1459
1457 ~~1501~~	Sample	"	"	400	075			
1501	NOx	"	"	0	076			
1507	Sample	"	"	400	086			
1520	NOx	"	"	0	086			PDS Sample 1520
1525	Sample	"	"	400	082 to 093			
1535	NOx	"	"	0	094			
1540	Sample	"	"	400	098 to 101			
1550	NOx	"	"	0	103			cell temp 111°F PDS Sample 1550
1555	Sample	"	"	400	106 to 114			

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/5/75

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TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1605	NOx	795	C E03 F469	0	115			
1610	Zero	"	"	400	015			
1615	Zero	"	C 803 F763	400	000	50		adjust fine zero
1618	Sample	"	"	400	111			
1623	NOx	"	"	0	113			
1628	Sample	"	"	400	120			
1635	NOx	"	"	0	122			
1640	Sample	"	"	400	126 to 139			
1650	NOx	"	"	0	138			PDS sample 1550 1660, cell temp 109 °F
1655	Sample	"	"	400	146 to 149			
1705	NOx	"	"	0	151 to 151			
1710	Sample	"	"	400	152 to 164			
1720	NOx	"	"	0	165			
1725	Zero	"	"	400	006			
1730	Zero	"	C E03 F761	400	000	50		adjust fine zero

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/5/75

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TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1732	Sample	795	C 803 F 461	400	171 to 173			
1737	NOx	11	11	0	178			
1742	Sample	11	11	400	182 to 189			cell temp 107°F
1750	NOx	11	11	0	194			PDS Sample 1750
1755	Sample	11	11	400	peak 194 096			sieve switched
1805	Zero	11	11	400	017			
1810	Zero	11	C 803 F454	400	000	50		adjust fine zero
1815	Zero	11	C 803 F454	400	000	30		adjust recorder zero to 30% of chart
1820	35ppm Span	11	11	400	032 to 035	36 to 37		cell temp 105°F
1830	Sample	11	11	400				

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/6/75 Zero Gas <0.1ppm NO_2 Cylinder Pressure 1475

Instrument Ser. No. 0166 Zero Gas 35ppm NO_2 Cylinder Pressure 1800

Location Hercules, Bessemer Na Outlet Oxygen _____ Cylinder Pressure 2350

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
0820	Sample	795	C803 F454	300	010			Instrument Operated During Night. Recorder Stopped
0830	Sample	"	"	"		Set Chart 0830 120mm/hr		Inking at 0520 AM Cell Temp 110°F
0833	Zero	"	"	400	-075	16		
0845	Zero	"	C803 F478	400	000	30		adjust fine zero
0853	35ppm Span	"	"	400	033	36.5		
0900	Sample	"	"	400	105 121 to			
0920	NO_x	"	"	0	124			
0925	Sample	"	"	400	124 134 to			
0935	NO_x	"	"	0	135			
0940	Sample	"	"	400	141 146 to			
0950	NO_x	"	"	0	148			
0955	Sample	"	"	400	150 155 to			
1005	NO_x	"	"	0	159			sieve switched to A
1010	Sample	"	"	400	111 to			
1020	NO_x	"	"	0	112			P.D. Sample 1021

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/6/75

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TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1025	Zero	795	C 803 F 454	400	023	34.8		cell temp 109°F
1035	Zero	795	C 803 F 470	400	000	30		adjust fine zero
1040	Sample	"	"	400	052			
1050	NO_x	"	"	0	054			
1055	Sample	"	"	400	057 to 063			
1105	NO_x	"	"	0	066			
1110	Sample	"	"	400	073 to 085			
1120	NO_x	"	"	0	086			pos sample 1120
1125	Sample	"	"	400	099 to 113			
1135	NO_x	"	"	0	113			
1140	Zero	"	"	400	025			
1145	Zero	"	C 803 F 460	400	000	30		adjust fine zero
1150	Sample	"	"	400	111 to 130			
1205	NO_x	"	"	0	132			
1210	Sample	"	"	400	135 to 147			

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/6/75

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TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1220	NOx	795	C803 F466	0	147			PDS Sample 1220
1225	Sample	"	"	400	160 to 178			cell temp 109°F
1235	NOx	"	"	0	turned wrong	valve		
1236	Sample	"	"	400	185 to 193			
1242	NOx	"	"	0	190			
1245	Sample	"	"	400	205 to 209			
1250	NOx	"	"	0	212			
1255	~~Sample~~ Zero	"	"	400	005	31		
1255	Zero	"	C803 F458	400	000	30		adjust Fine zero
1258	Sample	"	"	400	225 to 237			
1306	NOx	"	"	0	239			
1311	Sample	"	"	400	250 to 264			
1320	NOx	"	"	0	265			PDS Sample 1320
1325	Sample	"	"	400	270 to 268			
1335	NOx	"	"	0	268			

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/6/75

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TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1340	Sample	795	C803 F458	400	272 to 275			
1350	NOx	"	"	0	274			
1355	Sample	"	"	400	278 to 283			
1405	NOx	"	"	0	284			sieve switched 1408
1410	Sample	"	"	400	159 177 to			
1420	NOx	"	"	0	176			PDS Sample 1420
1425	Zero	"	[illegible]	400	-012	27.8		cell temp 108°F
1430	Zero	"	C803 F462	400	000	30		adjust fine zero
1435	Sample	"	"	400	112 084 to			
1450	NOx	"	"	[illegible]	083			
1455	Sample	"	"	400	080 077 to			
1505	NOx	"	"	0	079			
1510	Sample	"	"	400	081 085 to			
1520	NOx	"	"	0	087			PDS Sample 1520
1525	Zero	"	"	400	-008	28.5		

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER.

(Continued)

DATE 3/6/75

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TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1530	Zero	795	C803 F466	400	000	30		adjust fine zero
1535	Sample	"	"	400	109 to 115			
1550	NO_x	"	"	0	116			
1555	Sample	"	"	400	120 to 128			
1605	NO_x	"	"	0	127			
1610	Sample	"	"	400	134 to 141			
1620	NO_x	"	"	0	141			PDS Sample 1621
1625	Sample	"	"	400	149 to 154			
1635	NO_x	"	"	0	156			
1640	Zero	"	"	400	-002	29.5		
1646	Zero	"	C803 F468	400	000	30		adjust fine zero
1650	Sample	"	"	400	172 to 182			cell temp 108°F
1705	NO_x	"	"	0	187			
1710	Sample	"	"	400	179 to 172			
1720	NO_x	"	"	0	170			Upset Condition

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/6/75

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TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1723	Sample	795	C803 F468	400	170 to 302			Upset Condition
1735	NO_x	"	"	0	284			"
1740	Sample	"	"	200	150			"
1750	Sample	"	"	200	150			"
1755	Sample	"	"	300	146			
1810	Sample	"	"	300	165			1812
1828	Zero	"	"	400	+25	35		
1835	Zero	"	C 803 F 458	400	000	30		adjust fine zero
1843	35ppm Span	"	"	400	032			cell temp 106°F
1850	Sample	"	"	400				

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/7/75

Instrument Ser. No. 0166

Location Hercules, Bessemer Ala Outlet

Zero Gas <0.1 ppm NO_x Cylinder Pressure 1450

~~Zero~~ Span Gas 35 ppm NO_2 Cylinder Pressure 1800

Oxygen _____ Cylinder Pressure 2350

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
0840	Sample	795	C 803 F 458	200	048			Instrument Operated During Night. Recorder Stopped Inking
0850	Zero	"	"	400	-016	27		at 0500 3/7/75 Increase Record Chart Speed 120 mm/hr
0900	Zero	"	C 803 F 463	400	000	30		adjust fine zero
0904	Span	"	"	400	034	37 –		cell temp 105°F
0910	Sample	"	"	400	083 to 070			
0925	"	"	"	"	070 to 077			PDS Sample 0921
0940	"	"	"	"	077 093			
0955	Zero	"	"	400	028	35.75		
1000	Zero	"	C 803 F 452	400	000	30		adjust fine zero
1005	Sample	"	"	400	068 to 059			
1020	"	"	"	400	059 to 056			PDS Sample 1021
1030	"	"	"	400	056 to 097			
1050	"	"	"	400	097 to 130			
1105	"	"	"	400	130 to 163			
1120	NO_x	"	"	0	170			PDS Sample 1121

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/7/75

Page 2 of 0166 Outlet

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1125	Zero	795	C803 F452	400	016	33.3		
1130	Zero	"	C803 F447	400	000	30		adjust fine zero
1135	Sample	"	"	400	177 181 to			
1205	"	"	"	350	203 to 229			
1220	NOx	"	"	0	236			PDS Sample 1220
1225	Sample	"	"	400	234 238 to			cell temp 105°F
1240	"	"	"	"	238 245 to			
1255	"	"	"	"	245 122 to			sieve switched to 1255
1304	"	"	"	"	122 228 to			
1312	"	"	"	"	228 041 to			
1335	"	"	"	"	041			PDS Sample 1320
1336	Zero	"	"	400	-012	27.5		
1341	Zero	"	C803 F451	400	000	30		adjust fine zero
1345	Sample	"	"	400	048 049 to			
1400	"	"	"	"	049 to 053			

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/8/75

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TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1415	Sample	795	C803 F451	400	053			
1420	NOx	"	"	0	053			PDS Sample 1420
1425	Sample	"	"	400	060 066 to			cell temp 110°F
1440	zero	"	"	400	-020	26		
1450	zero	"	C803 F458	400	000	30		adjust fine zero
1456	Sample	"	"	400	087 to 086			
1510	"	"	"	400	086 to 085			
1523	NOx	"	"	0	083			PDS Sample 1523
1528	Sample	"	"	400	086 to 090			
1538	zero	"	"	400	-020	26		cell temp 111°F
1541	Zero	"	C803 F465	400	000	30		adjust fine zero
1544	Sample	"	"	400	110 to 114			
1600	"	"	"	"	114 to 126			
1620	NOx	"	"	0	125			PDS Sample 1620
1626	Sample	"	"	400	127 132 to			

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/7/75

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TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1640	Sample	795	C803 F465	400	132 to 136			
1655	"	"	"	"	136 to 138			PDS Sample 1654
1658	"	"	"	"	138			sieve switch 1658
1702	"	"	"	"	069			
1714	"	"	"	"	115			
1722	Zero	"	"	400	-006	28.8		
1727	Zero	"	C803 F467	400	000	30		adjust fine zero
1730	Span	"	"	400	031	36.		
1735	3980 Span	"	"	400	3950			Placed Analyzer on Range Two
								cell temp 110°F

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/10/75

Instrument Ser. No. 0166

Location Hercules, Bessemer Ala Outlet

Zero Gas <0.1 ppm NO_2 Cylinder Pressure 13

~~Zero~~ Span Gas 35 ppm NO_2 Cylinder Pressure 1700

Oxygen _____ Cylinder Pressure ~~1700~~ 2250

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
0835	Zero	795	C803 F467	400	142	58		
0840	Zero	795	C790 F466	400	000	30		adjust coarse and fine zero
0845	35 ppm Span	"	"	"	030	36		cell temp 100°F
0855	Zero	"	"	100		decreasing		
1355	Zero	"	"	400	-63	17.75		cell temp 110°F
1400	Zero	"	C790 F487	"	000	30		adjust fine zero

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/11/75

Instrument Ser. No. 0166 ~~8~~

Location Hercules, Bessemer Ala Outlet

Zero Gas <0.1 ppm NO_x Cylinder Pressure 1310

~~Zero~~ Span Gas 35 ppm NO_2 Cylinder Pressure 1650

Oxygen _____ Cylinder Pressure 2310

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
0805	Zero	795	C 790 F 487	400	+16	33.25		
0820	Zero	"	C 790 F 481	400	000	30		adjust fine zero
0825	"	"	"	025	000	30		
1300	"	"	"	400	-046	21		
1320	"	"	C 790 F 497	400	000	30		adjust fine zero
1325	Span	"	"	"	030	36		cell temperature 110°F
1350	Zero	"	"	400	+008	29.9		
1355	"	"	C 790 F 494	400	000	30		adjust fine zero
1356	Sample	"	"	"	017 to 023			
1420	NO_x	"	"	0	029			PDS Sample 1420
1425	Zero	"	"	400	019	39		
1430	"	"	C 790 F 488	"	000	30		adjust fine zero
1435	Sample	"	"	400	006 to 014			
1450	NO_x	"	"	0	014			PDS Sample 1450
1455	~~Sample~~ Zero	"	"	400	009 to 011			

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER.

(Continued)

DATE 3/11/75

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TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1500	Zero	795	C 790 F 488	400	000	30		adjust fine zero
1505	Sample	"	"	400	008 to 015			
1520	NO_x	"	"	0	015			PDS Sample 1520
1525	Zero	"	"	400	008			
1530	Zero	"	C 790 F 482	"	000	30		adjust fine zero
1535	Sample	"	C 790 F 482	400	011 to 015			
1550	NO_x	"	"	0	016			PDS Sample 1550
1555	Zero	"	"	400	004	30.8		
1600	Zero	"	C 790 F 480	"	000	30		adjust fine zero
1605	Sample	"	"	400	016 to 021			
1620	NO_x	"	"	0	023			PDS Sample 1620
1625	Zero	"	"	400	007			
1630	Zero	"	C 790 F 477	400	000	30		
1635	Sample	"	"	400	019 to 023			
1650	NO_x	"	"	0	023			PDS Sample 1650

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/~~12~~ 11/75

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TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1655	Zero ~~Sample~~	79.5	C790 F477	400	000	30		
1700	Sample	"	"	400	023 to 024			
1720	NOx	"	"	0	024			PDS Sample 1720
1725	Zero ~~Sample~~	"	"	400	-003			
1730	Zero	"	C790 F479	"	000	30		adjust Fine zero
1735	Sample	"	"	400	026 to 026			
1750	NOx	"	"	0	025			PDS Sample 1750
1755	Zero	"	"	400	-003	29.3		
1800	Zero	"	C790 F480	400	000	30		adjust fine zero
1804	Span	"	"	400	029	34.8		cell temp 108° F
1810	Sample	"	"	400				

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/12/75 Zero Gas <0.1ppm NO_x Cylinder Pressure 1300

Instrument Ser. No. 0166 Zero Gas 35ppm NO_x Cylinder Pressure 1650

Location Hercules, Bessemer Ala Outlet Oxygen _____ Cylinder Pressure 2300

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
0810	Sample	795	C 790 F 460	400	-26			
0815	Zero	"	"	400	-76	15		
0825	"	"	C790 F503	400	000	30		adjust fine zero
0840	Span	"	"	400	030 037 to			cell temp 112 °F
0845	zero	"	"	400	007 033 to			
0930	zero	"	C790 F491	400	000	30		adjust fine zero
0935	Sample	"	"	400	072 083 to			sieve switched 1002 B on absorb
1002	Sample	"	"	400	083 053 to 077			
1027	NO_x	"	"	0	077			PDS Sample 1028
1032	zero	"	"	400	010	32		
1037	zero	"	C790 F488	400	000	30		adjust fine zero
1040	Sample	"	"	400	046 to 049			
1122	NO_x	"	"	0	049			PDS Sample 1120
1127	zero	"	"	400	000	30		cell temp 113°F
1130	Sample	"	"	400	052 050 to			

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/12/75

Page 2 of 0166 Outlet

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1220	NOx	795	C790 F488	0	050			PDS sample 1220
1225	Zero	"	"	400	-008	28.25		cell temp 114°F
1230	Zero	"	C790 F490	400	000	30		adjust fine zero
1235	Sample	"	"	400	063 067 to			
1320	NOx	"	"	0	peak 066			
1325	Zero	"	"	400	-010			
1330	Zero	"	C790 F495	400	000	30		adjust fine zero
1335	Sample	"	"	400	077 101 to			1345 increased production sieve switched 1404 to A adsorb
1404	Sample	"	"	400	055 to 093 to 059			
1435	NOx	"	"	0	060			PDS Sample 1430
1440	Zero	"	"	400	011	32.25		
1445	Zero	"	C790 F491	400	000	30		adjust fine zero
1450	Sample	"	"	400	045 054 to			
1520	NOx	"	"	0	053			PDS Sample 1520
1525	Zero	"	"	400	003 005 to			

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/12/75

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TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1530 ~~ZERO~~	zero	795	C790 F488	400	000	30		adjust fine zero
1535	Sample	"	"	"	061 to 088			
1620	NO_x	"	"	0	090			PDS Sample 1620
1625	zero ~~Sample~~	"	"	400	016	33.3		
1633	zero	"	C790 F483	400	000	30		adjust fine zero cell temp 108°C
1638	Sample	"	"	400	077 to 096			
1720	NO_x	"	"	0	095			PDS Sample 1720
1725	zero ~~Sample~~	"	"	400	004	30.8		
1730	zero	"	C790 F482	"	000	30		adjust fine zero
1735	Sample	"	"	400	103 to 121			cell temp 109°F
1806	Sample	"	"	400	121			sieve switched
1810	zero	"	"	400	000	30		
1833	Span	"	"	400	031	36.2		cell temp 108°F
1845	Sample	"	"	400				

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/13/75

Instrument Ser. No. 0166

Location Hercules, Bessemer Ala Outlet

Zero Gas CO.1 ppm NO_x Cylinder Pressure 1200

Span Gas 3.5 ppm Cylinder Pressure

Oxygen Cylinder Pressure

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
0815	Sample	795	C790 F482	400	84			cell temp 105°F
0816	zero	"	"	400	+32	36.4		
0830	"	"	C790 F469	"	000	30		adjust fine zero
0845	Span	"	"	400	032	36.4		
0900	zero	"	"	400	000	30		
0907	Span	"	"	400	031	36.2		
0925	Sample	"	"	400	057 070			
1010	zero	"	"	400	010	32		
1013	zero	"	C790 F460	400	000	30		adjust fine zero
1016	Sample	"	"	400	041 054 to			sieve switched 1017 to B on Adsorb
1049	NO_x	"	"	0	056			Bypass opened 1050 PDS Sample 1049
1054	Sample	"	"	400	049 050 to			
1135	NO_x	"	"	0	051			PDS Sample 1135
1140	~~Sample~~ zero	"	"	400	022	34.3		
1145	zero	"	C790 F458	400				adjust fine zero increased production 1141

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/13/75

Page 2 of 0166 Outlet

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1150	Sample	795	C790 F458	400	030 to 052			
1222	NO_x	"	"	0	054			
1227	Zero	"	"	400	-004			cell temp 107°F
1232	Zero	"	C790 F460	400	000	30		adjust fine zero
1235	Sample	"	"	400	069 to 102			
1320	NO_x	"	"	0	102			
1325	Zero	"	"	400	-017	26.7		cell temp 108°F PDS Sample 1325
1330	Zero	"	C790 F466	"	000	30		adjust fine zero
1335	Sample	"	"	400	136 to 147			cell temp 109°F
1357	Sample	"	"	400	147 to 187			Sundyne off and on Bypass valve opened
1447	Zero	"	"	400	-012			cell temp 109°F
1450	Zero	"	C790 F470	400	000			adjust fine zero
1452	Sample	"	"	400	202 to 187			
1503	Sample	"	"	400	045			sieve switched to A on adsorb
1535	NO_x	"	"	0	044			PDS Sample 1535

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/13/75

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TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1540	Zero	795	C790 F458	400	-014	26.2		cell temp 110°F
1545	Zero	"	C790 F476	400	000	30		adjust fine zero
1550	Sample	"	"	400	051 to 093			
1635	NO_x	"	"	0	102 to 104			PDS Sample 1635 cell temp 109°F
1640	Zero	"	"	400	016	33		
1643	Zero	"	C790 F470	"	000	30		adjust fine zero
1645	Sample	"	"	400	102 to 148			
1730	Zero	"	"	400	005	31		
1733	Zero	"	C790 F467	"	000	30		adjust fine zero
1735	Sample	"	"	400	148 to 165			cell temp 108°F
1750	NO_x	"	"	0	165			PDS Sample 1735
1755	Sample	"	"	400	174 to 192			
1810	Zero	"	"	400	-005			
1813	Zero	"	C790 F470	"	000	30		adjust fine zero
1815	Sample	"	"	400	208 to 255			

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NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/13/75

Page 4 of 0166 Outlet

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
~~1845~~	NO_x	795	C790 F470	0	256			cell temp 108° F
1850	Sample	"	"	400	264 to 271			PDS Sample 1850
1905	Zero	"	"	400	+03	30.5		sieve switched to B on absorb
1910	"	"	C790 F469	400	000	30		adjust fine zero
1913	Span	"	"	400	032	36.5		cell temp 106° F
1920	Sample	"	"	400				

NO$_x$ FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

Date 3/14/75

Instrument Ser. No. 0166

Location Hercules, Bessemer Ala Outlet

Zero Gas <0.1 ppm NO$_x$ Cylinder Pressure 1150

~~Zero~~ Span Gas 35 ppm NO$_x$ Cylinder Pressure 1600

Oxygen _____ Cylinder Pressure 2200

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
0630	Sample	795	C790 F469	400				
0635	Zero	"	"	"	102	50.5		
0643	Zero	"	C790 F433	"	000	30		adjust fine zero
0645 ~~Span~~	Span	"	"	400	031	36		cell temp 98°C
0651	Sample	"	"	400	155 192 to			
0711	Sample	"	"	400	80 to 116 to			Sieve switch to A on Absorb 0711
0750	NO$_x$	"	"	0	068			
0755	Zero	"	"	400	008			PDS Sample 0755
0758	Zero	"	C790 F429	400	000	30		adjust fine zero
0802	Sample	"	"	400	056 099 to			
0848	NO$_x$	"	"	0	099			cell temp 102°F
0853	Zero	"	"	400	000	30		
0858	Sample	"	"	400	117 to 163			
0951	NO$_x$	"	"	0	163			PDS Sample 0951
0956	Zero	"	"	400	000	30		

NO_x FIELD DATA

DUPONT 411 PHOTOMETRIC ANALYZER

(Continued)

DATE 3/19/75

Page 2 of 0166 Output

TIME	MODE	(Indicate Adjustments) SPAN SETTING	ZERO SETTING	FLOW (cc/min)	METER CONC. (ppm)	AVERAGE RECORDER % OF CHART	CONC. FROM CHART (ppm)	COMMENTS
1000	Sample	795	C790 F429	400	183 to 235			
1051	NO_x	"	"	0	235			PDS sample 1051 cell temp 101°F
1056	Zero	"	"	400	-001			
1058	Zero	"	C790 F430	"	000	30		adjust fine zero
1100	Sample	"	"	400	241 to 299			
1114	Sample	"	"	400	249			sieve switched 1114
1115	Zero	"	"	400	+003	30.75		
1122	Zero	"	C790 F429	400	000	30		adjust fine zero
1127	Span	"	"	400	032			cell temp 100

APPENDIX E

FIELD DATA FOR EPA METHOD NO. 7 TESTS

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 06 Mar 75

RUN NO. CAL. GAS.

Hercules, Inc. Bessemer, Ala. 3980 ppm

		1	2	3
	Time			
	Flask Number	6	7	8
V_f	Volume of Flask and Valve, ml	2073	2099	2058
V_a	Volume of Absorbing Reagent, ml	25	25	25
V_n	Volume of Flask minus Reagent, ml	2048	2074	2033
P_{bi}	Initial Barometric Presure, in. Hg	29.78	29.76	29.76
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.75	26.65	26.50
P_i	Initial Absolute Pressure in Flask, in. Hg	3.01	3.11	3.26
P_{bf}	Final Barometric Pressure, in. Hg	29.53	29.80	29.80
P_{ff}	Final Flask Vacuum in. Hg vac	-8.78	-2.85	-2.35
P_f	Final Absolute Pressure in Flask, in. Hg	20.75	26.95	27.45
T_i	Initial Flask Temperature, °F	75	75	63
T_{ir}	Initial Flask Temperature, °R	535	535	523
T_f	Final Flask Temperature, °F	74	66	68
T_{fr}	Final Flask Temperature, °R	534	526	528
V_{sc}	Volume of Sample at Dry Std. Cond., ml	1205	1668	1647
M	Mass of NO_2 in Gas Sample, µg	6,250	13,350	12,750
C	Concentration of NO_x as NO_2, dry basis, lb/scf	3.215 x [illegible]	4.961 x [illegible]	[illegible] x 10^{-4}
	ppmv	2705	4174	4037

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

$$ppmv = \frac{(C)(387 \times 10^6)}{46}$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 07 MAR 75

RUN NO. Cal Gas

Hercules Inc Bessemer Ala

		4 ~~3~~	5 ~~4~~	6 ~~5~~
	Time			
	Flask Number	10	11	12
V_f	Volume of Flask and Valve, ml	2050	2052	2067
V_a	Volume of Absorbing Reagent, ml	25	25	25
V_n	Volume of Flask minus Reagent, ml	2025	2027	2042
P_{bi}	Initial Barometric Presure, in. Hg	29.76	2975	2975
P_{fi}	Initial Flask Vacuum, in. Hg vac	2660	2665	2660
P_i	Initial Absolute Pressure in Flask, in. Hg	3.16	3.10	3.15
P_{bf}	Final Barometric Pressure, in. Hg	29.80	29.80	29.80
P_{ff}	Final Flask Vacuum in. Hg vac	0.00	0.00	-1.60
P_f	Final Absolute Pressure in Flask, in. Hg	29.30	29.30	28.20
T_i	Initial Flask Temperature, °F	74	74	74
T_{ir}	Initial Flask Temperature, °R	534	534	534
T_f	Final Flask Temperature, °F	68	68	68
T_{fr}	Final Flask Temperature, °R	528	528	528
V_{sc}	Volume of Sample at Dry Std. Cond., ml	1812	1818	1718
M	Mass of NO_2 in Gas Sample, µg	142	138	142
C	Concentration of NO_x as NO_2, dry basis, lb/scf	4.859×10^{-6}	4.707×10^{-6}	5.124×10^{-6}
		[illegible]	39.6	[illegible]

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

$$PPMV = \frac{(C)(3.97 \times 10^{6})}{46}$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 05 Mar. 75

RUN NO. inlet HV-12

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Hercules Inc. Bessemer, Ala.

		Run No. HV-12-1	HV-12-1	HV-12-2
	Time	CONTAMINATE	1316	1345
	Flask Number	*1	3	5
V_f	Volume of Flask and Valve, ml	2039	1965	1955
V_a	Volume of Absorbing Reagent, ml	25	25	25
V_n	Volume of Flask minus Reagent, ml	2014	1940	1930
P_{bi}	Initial Barometric Presure, in. Hg	29.75	29.75	29.74
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.00	26.50	26.65
P_i	Initial Absolute Pressure in Flask, in. Hg		3.25	3.09
P_{bf}	Final Barometric Pressure, in. Hg		29.76	29.77
P_{ff}	Final Flask Vacuum in. Hg vac		-0.50	-1.90
P_f	Final Absolute Pressure in Flask, in. Hg		29.26	24.87
T_i	Initial Flask Temperature, °F	73	75	74
T_{ir}	Initial Flask Temperature, °R		535	535
T_f	Final Flask Temperature, °F		71	70
T_{fr}	Final Flask Temperature, °R		531	530
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, µg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

* H_2O sucked back from bypass line

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 05 Mar 75

RUN NO. inlet . HV-12

Hercules, Inc. Bessemer, Ala.

		Run No. - HV-12-3	HV-12-4	HV-12-5
	Time	1415	1446	1516
	Flask Number	7	9	11
V_f	Volume of Flask and Valve, ml	2116	2053	2069
V_a	Volume of Absorbing Reagent, ml	25	25	25
V_n	Volume of Flask minus Reagent, ml	2091	2028	2044
P_{bi}	Initial Barometric Presure, in. Hg	29.72	29.71	29.71
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.60	26.60	26.70
P_i	Initial Absolute Pressure in Flask, in. Hg	3.12	3.11	3.01
P_{bf}	Final Barometric Pressure, in. Hg	29.78	29.77	29.73
P_{ff}	Final Flask Vacuum in. Hg vac	-0.05	-0.60	+0.20
P_f	Final Absolute Pressure in Flask, in. Hg	29.73	29.17	29.93
T_i	Initial Flask Temperature, °F	75	75	70
T_{ir}	Initial Flask Temperature, °R	535	535	530
T_f	Final Flask Temperature, °F	70	73	81
T_{fr}	Final Flask Temperature, °R	530	533	541
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, μg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\ (V_n) \left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}} \right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5}) \left[\frac{M}{V_{sc}} \right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 05 Mar. 75

RUN NO. inlet - HV-12

Hercules, Inc. Bessemer, Ala.

		Run No. - HV-12-6	HV-12-7	HV-12-8
	Time	1545	1645	1745
	Flask Number	13	15	1
V_f	Volume of Flask and Valve, ml	2071	2064	2039
V_a	Volume of Absorbing Reagent, ml	25	25	25
V_n	Volume of Flask minus Reagent, ml	2046	2039	2014
P_{bi}	Initial Barometric Presure, in. Hg	29.70	29.68	29.66
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.60	26.65	26.60
P_i	Initial Absolute Pressure in Flask, in. Hg	3.10	3.03	3.06
P_{bf}	Final Barometric Pressure, in. Hg	29.73	29.72	29.76
P_{ff}	Final Flask Vacuum in. Hg vac	0.00	+0.05	+0.35
P_f	Final Absolute Pressure in Flask, in. Hg	29.73	29.77	30.61
T_i	Initial Flask Temperature, °F	73	68	71
T_{ir}	Initial Flask Temperature, °R	533	528	531
T_f	Final Flask Temperature, °F	76	75	71
T_{fr}	Final Flask Temperature, °R	536	535	531
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, μg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\ (V_n) \left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}} \right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5}) \left[\frac{M}{V_{sc}} \right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 06 Mar 75

RUN NO. Inlet HU-12

Hercules, Inc. Bessemer, Ala. Run No HU-12 HU-12-10 HU-12-

	Time	1015	1115	1215
	Flask Number	1	3	5
V_f	Volume of Flask and Valve, ml	2039	1965	1955
V_a	Volume of Absorbing Reagent, ml	25	25	25
V_n	Volume of Flask minus Reagent, ml	2014	1940	1930
P_{bi}	Initial Barometric Presure, in. Hg	29.78	29.77	29.76
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.40	26.60	26.65
P_i	Initial Absolute Pressure in Flask, in. Hg	3.38	3.17	3.11
P_{bf}	Final Barometric Pressure, in. Hg	29.65	29.64	29.64
P_{ff}	Final Flask Vacuum in. Hg vac	+0.45	-5.85	-1.95
P_f	Final Absolute Pressure in Flask, in. Hg	30.10	23.79	27.69
T_i	Initial Flask Temperature, °F	75	73	73
T_{ir}	Initial Flask Temperature, °R	535	533	533
T_f	Final Flask Temperature, °F	74	73	73
T_{fr}	Final Flask Temperature, °R	534	533	533
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, µg			
	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\ (V_n) \left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}} \right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5}) \left| \frac{M}{V_{sc}} \right|$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 06-MAR 75

RUN NO. Inlet HV-12

Hercules, Inc. Bessemer, Ala. Run No.

		HV-12-12	HV-12-13	HV-12-14
	Time	1316	1415	1515
	Flask Number	7	9	11
V_f	Volume of Flask and Valve, ml	2116	2053	2069
V_a	Volume of Absorbing Reagent, ml	25	25	25
V_n	Volume of Flask minus Reagent, ml	2091	2028	2044
P_{bi}	Initial Barometric Presure, in. Hg	29.75	29.73	29.73
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.50	26.35	26.40
P_i	Initial Absolute Pressure in Flask, in. Hg	3.25	3.38	3.33
P_{bf}	Final Barometric Pressure, in. Hg	29.63	29.61	29.60
P_{ff}	Final Flask Vacuum in. Hg vac	+0.05	-1.75	-1.05
P_f	Final Absolute Pressure in Flask, in. Hg	29.68	27.86	28.55
T_i	Initial Flask Temperature, °F	74	74	71
T_{ir}	Initial Flask Temperature, °R	534	534	534
T_f	Final Flask Temperature, °F	73	73	72
T_{fr}	Final Flask Temperature, °R	533	533	532
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, μg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 06 MAR 75

RUN NO. Inlet HU12

Hercules Inc Bessemer Ala.

		Run No. HU12-15	HU-12-16	
	Time	1616	1715	
	Flask Number	13	15	
V_f	Volume of Flask and Valve, ml	2071	2064	
V_a	Volume of Absorbing Reagent, ml	25	25	
V_n	Volume of Flask minus Reagent, ml	2046	2039	
P_{bi}	Initial Barometric Presure, in. Hg	29.71	29.70	
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.50	26.45	
P_i	Initial Absolute Pressure in Flask, in. Hg	3.21	3.25	
P_{bf}	Final Barometric Pressure, in. Hg	29.61	29.58	
P_{ff}	Final Flask Vacuum in. Hg vac	+0.45	-6.10	
P_f	Final Absolute Pressure in Flask, in. Hg	30.06	23.48	
T_i	Initial Flask Temperature, °F	75	73	
T_{ir}	Initial Flask Temperature, °R	535	533	
T_f	Final Flask Temperature, °F	73	74	
T_{fr}	Final Flask Temperature, °R	533	534	
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, µg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 7 MAR 75

RUN NO. HV-12 - Inlet

Hercules, Inc. Bessemer, Ala. Run No. HV-12-17 HV-12-18 HV-12-19

	Time	915	1015	1115
	Flask Number	1	3	5
V_f	Volume of Flask and Valve, ml	2039	1965	1955
V_a	Volume of Absorbing Reagent, ml	25	25	25
V_n	Volume of Flask minus Reagent, ml	2014	1940	1930
P_{bi}	Initial Barometric Presure, in. Hg	29.65	29.63	29.61
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.45	26.55	26.25
P_i	Initial Absolute Pressure in Flask, in. Hg	3.20	3.08	3.36
P_{bf}	Final Barometric Pressure, in. Hg	29.83	29.84	29.84
P_{ff}	Final Flask Vacuum in. Hg vac	-2.10	-0.90	-4.85
P_f	Final Absolute Pressure in Flask, in. Hg	27.73	28.94	24.99
T_i	Initial Flask Temperature, °F	74	73	72
T_{ir}	Initial Flask Temperature, °R	534	533	532
T_f	Final Flask Temperature, °F	67	65	65
T_{fr}	Final Flask Temperature, °R	527	525	525
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, µg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\ (V_n) \left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}} \right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5}) \left[\frac{M}{V_{sc}} \right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 07 MAR

RUN NO. HV12 Inlet

Hercules, Inc. Bessemer Ala. Run No. HV12-20 HV12-21 HV12-22

	Time	1215	1316	1415
	Flask Number	7	9	11
V_f	Volume of Flask and Valve, ml	2116	2053	2069
V_a	Volume of Absorbing Reagent, ml	25	25	25
V_n	Volume of Flask minus Reagent, ml	2091	2028	2044
P_{bi}	Initial Barometric Presure, in. Hg	29.61	29.60	29.58
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.35	26.50	26.25
P_i	Initial Absolute Pressure in Flask, in. Hg	3.26	3.10	3.33
P_{bf}	Final Barometric Pressure, in. Hg	29.85	29.84	29.82
P_{ff}	Final Flask Vacuum in. Hg vac	-1.75	-3.55	-4.10
P_f	Final Absolute Pressure in Flask, in. Hg	28.10	26.29	25.72
T_i	Initial Flask Temperature, °F	72	73	76
T_{ir}	Initial Flask Temperature, °R	532	533	536
T_f	Final Flask Temperature, °F	64	65	65
T_{fr}	Final Flask Temperature, °R	524	525	525
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, µg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 07 MAR 75

RUN NO. HV 12 Inlet

Hercules Inc. Bessemer, Ala

		Run No. HV12-23	HV12-24	HV12-25
	Time	1517	1615	1658 ~~1700~~
	Flask Number	13	15	6
V_f	Volume of Flask and Valve, ml	2071	2064	2073
V_a	Volume of Absorbing Reagent, ml	25	25	25
V_n	Volume of Flask minus Reagent, ml	2046	2039	2048
P_{bi}	Initial Barometric Presure, in. Hg	29.56	29.53	29.54
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.50	26.35	26.50
P_i	Initial Absolute Pressure in Flask, in. Hg	3.06	3.18	3.04
P_{bf}	Final Barometric Pressure, in. Hg	29.82	29.82	29.82
P_{ff}	Final Flask Vacuum in. Hg vac	-1.75	-4.10	-1.00
P_f	Final Absolute Pressure in Flask, in. Hg	28.07	25.72	28.82
T_i	Initial Flask Temperature, °F	77	75	78
T_{ir}	Initial Flask Temperature, °R	537	535	538
T_f	Final Flask Temperature, °F	65	65	65
T_{fr}	Final Flask Temperature, °R	525	525	525
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, μg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\ (V_n) \left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5}) \left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 11 MAR 75 PLANT Hercules Inc.

RUN NO. Inlet HU12 LOCATION Bessemer, Ala.

	Run No	HU12-26	HU12-27	HU12-28
	Time	1415	1445	1515
	Flask Number	1	3	5
V_f	Volume of Flask and Valve, ml	2039	1965	1955
V_a	Volume of Absorbing Reagent, ml	25	25	25
V_n	Volume of Flask minus Reagent, ml	2014	1940	1930
P_{bi}	Initial Barometric Presure, in. Hg	29.65	29.65	29.62
P_{fi}	Initial Flask Vacuum, in. Hg vac	27.35	27.10	26.75
P_i	Initial Absolute Pressure in Flask, in. Hg	2.30	2.55	2.87
P_{bf}	Final Barometric Pressure, in. Hg	29.51	29.51	29.50
P_{ff}	Final Flask Vacuum in. Hg vac	+0.55	-0.30	+0.20
P_f	Final Absolute Pressure in Flask, in. Hg	30.06	28.71	29.70
T_i	Initial Flask Temperature, °F	74	73	75
T_{ir}	Initial Flask Temperature, °R	534	533	535
T_f	Final Flask Temperature, °F	78	78	78
T_{fr}	Final Flask Temperature, °R	538	538	538
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, μg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

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NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 11 MAR 75 PLANT Hercules INC.

RUN NO. Inlet HV12 Location Bessemer Ala

		Run No	HV12-29	HV12-30 (1/3 outlet)	HV12-31
	Time		1545	1615	1645
	Flask Number		8	9	11
V_f	Volume of Flask and Valve, ml	2080	~~2116~~	2053	2069
V_a	Volume of Absorbing Reagent, ml	25	~~25~~	25	25
V_n	Volume of Flask minus Reagent, ml	2055	~~2091~~	2028	2044
P_{bi}	Initial Barometric Presure, in. Hg	29.62	~~29.62~~	29.61	29.60
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.60	~~26.70~~	26.65	26.75
P_i	Initial Absolute Pressure in Flask, in. Hg		302	2.96	2.85
P_{bf}	Final Barometric Pressure, in. Hg		29.53	29.55	29.55
P_{ff}	Final Flask Vacuum in. Hg vac		-7.50	-3.80	-2.25
P_f	Final Absolute Pressure in Flask, in. Hg		22.03	25.75	27.30
T_i	Initial Flask Temperature, °F	77	~~77~~	73	75
T_{ir}	Initial Flask Temperature, °R		537	533	535
T_f	Final Flask Temperature, °F		78	79	77
T_{fr}	Final Flask Temperature, °R		538	539	537
V_{sc}	Volume of Sample at Dry Std. Cond., ml				
M	Mass of NO_2 in Gas Sample, µg				
C	Concentration of NO_x as NO_2, dry basis, lb/scf				

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 11 MAR 75 PLANT Hercules Inc.

RUN NO. Inlet HV 12 LOCATION Bessemer, Ala.

	Run No.	HV12 32	HV12 33	~~HV12 34~~
	Time	1715	1745	
	Flask Number	8 (E)	15	
V_f	Volume of Flask and Valve, ml	2058	2064	
V_a	Volume of Absorbing Reagent, ml	25	25	
V_n	Volume of Flask minus Reagent, ml	2033	2039	
P_{bi}	Initial Barometric Presure, in. Hg	29.60	29.60	
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.75	26.65	
P_i	Initial Absolute Pressure in Flask, in. Hg	2.85	2.95	
P_{bf}	Final Barometric Pressure, in. Hg	29.55	29.50	
P_{ff}	Final Flask Vacuum in. Hg vac	+1.50	-0.90	
P_f	Final Absolute Pressure in Flask, in. Hg	31.05	28.60	
T_i	Initial Flask Temperature, °F	73	75	
T_{ir}	Initial Flask Temperature, °R	533	535	
T_f	Final Flask Temperature, °F	77	76	
T_{fr}	Final Flask Temperature, °R	537	536	
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, μg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 12 MAR 75 Plant Hercules Inc.

RUN NO. Inlet HV12 Location Bessemer, Ala.

	Run No	HV12-34	HV12-35	HV12-36
	Time	1023	1117	1215
	Flask Number	1	3	5
V_f	Volume of Flask and Valve, ml	2039	1965	1955
V_a	Volume of Absorbing Reagent, ml	25	25	25
V_n	Volume of Flask minus Reagent, ml	2014	1940	1930
P_{bi}	Initial Barometric Presure, in. Hg	29.53	29.53	29.55
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.55	26.45	26.45
P_i	Initial Absolute Pressure in Flask, in. Hg	2.98	3.08	3.10
P_{bf}	Final Barometric Pressure, in. Hg	29.46	29.47	29.46
P_{ff}	Final Flask Vacuum in. Hg vac	-0.65	-1.05	-2.05
P_f	Final Absolute Pressure in Flask, in. Hg	28.81	28.42	27.41
T_i	Initial Flask Temperature, °F	77	78	78
T_{ir}	Initial Flask Temperature, °R	537	538	538
T_f	Final Flask Temperature, °F	75	73	72
T_{fr}	Final Flask Temperature, °R	535	533	532
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, μg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 12 MAR 75 PLANT Hercules INC.

RUN NO. Inlet HV12 LOCATION Bessemer Ala

	RUN	HV12-37	HV12-33	HV12-39
	Time	1316	1430	1516
	Flask Number	7	9	11
V_f	Volume of Flask and Valve, ml	2116	2063	2069
V_a	Volume of Absorbing Reagent, ml	25	25	25
V_n	Volume of Flask minus Reagent, ml	2091	2038	2044
P_{bi}	Initial Barometric Presure, in. Hg	29.55	29.54	29.51
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.35	26.40	26.20
P_i	Initial Absolute Pressure in Flask, in. Hg	3.20	3.14	3.31
P_{bf}	Final Barometric Pressure, in. Hg	29.42	29.42	29.33
P_{ff}	Final Flask Vacuum in. Hg vac	+0.05	-0.45	-0.20
P_f	Final Absolute Pressure in Flask, in. Hg	29.47	28.97	29.13
T_i	Initial Flask Temperature, °F	78	78	77
T_{ir}	Initial Flask Temperature, °R	538	538	537
T_f	Final Flask Temperature, °F	68	68	74
T_{fr}	Final Flask Temperature, °R	528	528	534
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, μg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 12 MAR 75

RUN NO. HV12 Inlet

Hercules Inc. Bessemer Ala Run No. HV 12-4c | HV12-11

	Time	1615	1715	
	Flask Number	8 ES	15	
V_f	Volume of Flask and Valve, ml	2058	2064	
V_a	Volume of Absorbing Reagent, ml	25	25	
V_n	Volume of Flask minus Reagent, ml	2033	2039	
P_{bi}	Initial Barometric Presure, in. Hg	29.50	29.48	
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.40	26.35	
P_i	Initial Absolute Pressure in Flask, in. Hg	3.10	3.13	
P_{bf}	Final Barometric Pressure, in. Hg	29.33	29.32	
P_{ff}	Final Flask Vacuum in. Hg vac	0.00	-0.40	
P_f	Final Absolute Pressure in Flask, in. Hg	29.33	28.92	
T_i	Initial Flask Temperature, °F	77	76	
T_{ir}	Initial Flask Temperature, °R	537	536	
T_f	Final Flask Temperature, °F	70	71	
T_{fr}	Final Flask Temperature, °R	530	531	
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, μg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\ (V_n) \left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}} \right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5}) \left[\frac{M}{V_{sc}} \right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 13 MAR 74

RUN NO. Inlet HV12

Hercules Inc Bessemer Ala. Run No

		HV12-42	HV12-43	HV12-44
	Time	1047	1132	1219
	Flask Number	1	3	5
V_f	Volume of Flask and Valve, ml	2039	1965	1955
V_a	Volume of Absorbing Reagent, ml	25	25	25
V_n	Volume of Flask minus Reagent, ml	2014	1940	1930
P_{bi}	Initial Barometric Presure, in. Hg	29.44	29.43	29.41
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.35	26.25	26.35
P_i	Initial Absolute Pressure in Flask, in. Hg	3.09	3.18	3.06
P_{bf}	Final Barometric Pressure, in. Hg	29.56	29.59	29.63
P_{ff}	Final Flask Vacuum in. Hg vac	-2.90	-3.30	-3.60
P_f	Final Absolute Pressure in Flask, in. Hg	26.66	26.29	26.03
T_i	Initial Flask Temperature, °F	70	68	70
T_{ir}	Initial Flask Temperature, °R	530	528	530
T_f	Final Flask Temperature, °F	59	58	59
T_{fr}	Final Flask Temperature, °R	519	518	519
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, μg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 13 MAR 75

RUN NO. Inlet HV12

Hercules Inc - Bessemer, Ala. Run No -

		HV1245	46	47
	Time	1317	1530	1632
	Flask Number	7	9	11
V_f	Volume of Flask and Valve, ml	2116	2063	2069
V_a	Volume of Absorbing Reagent, ml	25	25	25
V_n	Volume of Flask minus Reagent, ml	2091	2038	2044
P_{bi}	Initial Barometric Presure, in. Hg	29.39	29.32	29.32
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.30	26.30	26.35
P_i	Initial Absolute Pressure in Flask, in. Hg	3.09	3.02	2.97
P_{bf}	Final Barometric Pressure, in. Hg	29.65	29.70	29.70
P_{ff}	Final Flask Vacuum in. Hg vac	-2.25	-2.65	-1.35
P_f	Final Absolute Pressure in Flask, in. Hg	27.40	27.05	28.35
T_i	Initial Flask Temperature, °F	73	73	77
T_{ir}	Initial Flask Temperature, °R	533	533	537
T_f	Final Flask Temperature, °F	59	59	59
T_{fr}	Final Flask Temperature, °R	519	519	519
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, μg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE MAR 75

RUN NO. Inlet - HV 12

Hercules Inc. Bessemer, Ala. Run No. HV12-48 | 49

	Time	1732	1847	
	Flask Number	8 (ES)	15	
V_f	Volume of Flask and Valve, ml	2058	2064	
V_a	Volume of Absorbing Reagent, ml	25	25	
V_n	Volume of Flask minus Reagent, ml	2033	2039	
P_{bi}	Initial Barometric Presure, in. Hg	29.35	29.26	
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.30	26.25	
P_i	Initial Absolute Pressure in Flask, in. Hg	3.05	3.01	
P_{bf}	Final Barometric Pressure, in. Hg	29.70	29.70	
P_{ff}	Final Flask Vacuum in. Hg vac	-2.25	-1.85	
P_f	Final Absolute Pressure in Flask, in. Hg	27.45	27.85	
T_i	Initial Flask Temperature, °F	70	72	
T_{ir}	Initial Flask Temperature, °R	530	532	
T_f	Final Flask Temperature, °F	59	60	
T_{fr}	Final Flask Temperature, °R	519	520	
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, µg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 14 MAR 75

RUN NO. INlet HV12

Hercules, Inc. Bessemer Ala. Run No

		50	51	52
	Time	0747	0847	947
	Flask Number	1	3	5
V_f	Volume of Flask and Valve, ml	2039	1965	1955
V_a	Volume of Absorbing Reagent, ml	25	25	25
V_n	Volume of Flask minus Reagent, ml	2014	1940	1930
P_{bi}	Initial Barometric Presure, in. Hg	29.59	29.62	29.63
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.45	26.50	26.70
P_i	Initial Absolute Pressure in Flask, in. Hg	3.14	3.12	2.93
P_{bf}	Final Barometric Pressure, in. Hg	29.79	29.79	29.79
P_{ff}	Final Flask Vacuum in. Hg vac	-0.65	-0.75	-0.35
P_f	Final Absolute Pressure in Flask, in. Hg	29.14	29.04	29.44
T_i	Initial Flask Temperature, °F	60	60	60
T_{ir}	Initial Flask Temperature, °R	520	520	520
T_f	Final Flask Temperature, °F	51	51	54
T_{fr}	Final Flask Temperature, °R	511	511	514
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, μg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\ (V_n) \left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5}) \left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 14 MAR 75

RUN NO. Inlet HV-12

Hercules Inc. Bessemer Ala. Run No 53

	Time	1047		
	Flask Number	7		
V_f	Volume of Flask and Valve, ml	2116		
V_a	Volume of Absorbing Reagent, ml	25		
V_n	Volume of Flask minus Reagent, ml	2091		
P_{bi}	Initial Barometric Presure, in. Hg	29.66		
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.65		
P_i	Initial Absolute Pressure in Flask, in. Hg	3.01		
P_{bf}	Final Barometric Pressure, in. Hg	29.79		
P_{ff}	Final Flask Vacuum in. Hg vac	-1.35		
P_f	Final Absolute Pressure in Flask, in. Hg	28.44		
T_i	Initial Flask Temperature, °F	59		
T_{ir}	Initial Flask Temperature, °R	519		
T_f	Final Flask Temperature, °F	54		
T_{fr}	Final Flask Temperature, °R	514		
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, μg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\ (V_n) \left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}} \right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5}) \left| \frac{M}{V_{sc}} \right|$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 05 Mar 75

RUN NO. outlet - HV-13

Hercules Inc Bessemer Ala.

		Run No. - HV-13-1	HV-13-2	HV-13-3
	Time	1258	1318	1350
	Flask Number	2	4	6
V_f	Volume of Flask and Valve, ml	2035	2041	1984
V_a	Volume of Absorbing Reagent, ml	25	25	25
V_n	Volume of Flask minus Reagent, ml	2010	2016	1959
P_{bi}	Initial Barometric Presure, in. Hg	29.75	29.75	29.74
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.40	26.65	26.50
P_i	Initial Absolute Pressure in Flask, in. Hg	3.35	3.10	3.24
P_{bf}	Final Barometric Pressure, in. Hg	29.76	29.76	29.77
P_{ff}	Final Flask Vacuum in. Hg vac	+0.05	-1.50	-0.05
P_f	Final Absolute Pressure in Flask, in. Hg	29.81	28.26	29.72
T_i	Initial Flask Temperature, °F	73	75	73
T_{ir}	Initial Flask Temperature, °R	533	535	533
T_f	Final Flask Temperature, °F	71	70	70
T_{fr}	Final Flask Temperature, °R	531	530	530
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, μg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 05 Mar. 75

RUN NO. Outlet - HV-13

Hercules, Inc Bessemer, Ala.

		Run No. - HV-13-4	HV-13-5	HV-13-6
	Time	1420	1454	1520
	Flask Number	8	10*	12
V_f	Volume of Flask and Valve, ml	2080	2053	2076
V_a	Volume of Absorbing Reagent, ml	25	25	25
V_n	Volume of Flask minus Reagent, ml	2055	2028	2051
P_{bi}	Initial Barometric Presure, in. Hg	29.72	29.71	29.71
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.55	26.60	26.55
P_i	Initial Absolute Pressure in Flask, in. Hg	3.17	3.11	3.16
P_{bf}	Final Barometric Pressure, in. Hg	29.78	29.77	29.73
P_{ff}	Final Flask Vacuum in. Hg vac	0.00	+1.25	+0.45
P_f	Final Absolute Pressure in Flask, in. Hg	29.78	31.02	30.13
T_i	Initial Flask Temperature, °F	75	75	73
T_{ir}	Initial Flask Temperature, °R	535	535	533
T_f	Final Flask Temperature, °F	73	73	73
T_{fr}	Final Flask Temperature, °R	533	533	533
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, μg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\ (V_n) \left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}} \right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5}) \left[\frac{M}{V_{sc}} \right]$$

* E.S. STOPCOCK No. 9 must be calibrated

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 05 MAR 75

RUN NO. HV-13 Outlet

Hercules Inc. Bessemer Ala.

		HV13-7	HV13-8	HV13-9
	Time	1550	1650	1750
	Flask Number	14	16*	18
V_f	Volume of Flask and Valve, ml	2124	2021	2078
V_a	Volume of Absorbing Reagent, ml	25	25	25
V_n	Volume of Flask minus Reagent, ml	2099	2021	2053
P_{bi}	Initial Barometric Presure, in. Hg	29.70	29.68	29.66
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.55	26.55	26.60
P_i	Initial Absolute Pressure in Flask, in. Hg	+3.15	3.13	3.06
P_{bf}	Final Barometric Pressure, in. Hg	29.72	29.72	29.70
P_{ff}	Final Flask Vacuum in. Hg vac	+1.20	+1.40	+2.00
P_f	Final Absolute Pressure in Flask, in. Hg	30.92	31.12	31.70
T_i	Initial Flask Temperature, °F	73	70	71
T_{ir}	Initial Flask Temperature, °R	533	530	531
T_f	Final Flask Temperature, °F	74	74	74
T_{fr}	Final Flask Temperature, °R	534	534	534
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, μg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left|\frac{M}{V_{sc}}\right|$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 06 Mar 75

RUN NO. Outlet-HV-13-

Hercules Inc Bessemer, Ala.

		Run No. HV-13-10	HV-13-11	HV-13-12
	Time	1021	1120	1220
	Flask Number	2	4	6
V_f	Volume of Flask and Valve, ml	2035	2041	1984
V_a	Volume of Absorbing Reagent, ml	25	25	25
V_n	Volume of Flask minus Reagent, ml	2010	2016	1959
P_{bi}	Initial Barometric Presure, in. Hg	29.78	29.77	29.76
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.65	26.65	26.55
P_i	Initial Absolute Pressure in Flask, in. Hg	3.13	3.12	3.21
P_{bf}	Final Barometric Pressure, in. Hg	29.65	29.64	29.63
P_{ff}	Final Flask Vacuum in. Hg vac	-0.65	-0.10	-1.45
P_f	Final Absolute Pressure in Flask, in. Hg	29.00	29.54	28.18
T_i	Initial Flask Temperature, °F	73	73	72
T_{ir}	Initial Flask Temperature, °R	533	533	532
T_f	Final Flask Temperature, °F	73	73	73
T_{fr}	Final Flask Temperature, °R	533	533	533
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, µg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\ (V_n) \left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}} \right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5}) \left| \frac{M}{V_{sc}} \right|$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 06 MAR 75

RUN NO. HL-13 Outlet

Hercules, Inc. - Bessemer, Ala.

	Run No.	HL-13-13	HL-13-14	HL-13-15
	Time	1320	1420	1520
	Flask Number	8	10	12
V_f	Volume of Flask and Valve, ml	2080	2053	2076
V_a	Volume of Absorbing Reagent, ml	25	25	25
V_n	Volume of Flask minus Reagent, ml	2055	2028	2051
P_{bi}	Initial Barometric Presure, in. Hg	29.75	29.73	29.73
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.45	26.40	26.50
P_i	Initial Absolute Pressure in Flask, in. Hg	3.30	3.33	3.23
P_{bf}	Final Barometric Pressure, in. Hg	29.61	29.61	29.61
P_{ff}	Final Flask Vacuum in. Hg vac	-5.75	-0.50	-4.55
P_f	Final Absolute Pressure in Flask, in. Hg	23.86	30.11	25.06
T_i	Initial Flask Temperature, °F	74	74	74
T_{ir}	Initial Flask Temperature, °R	534	534	534
T_f	Final Flask Temperature, °F	72	72	73
T_{fr}	Final Flask Temperature, °R	532	532	533
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, μg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 06 MAR 75

RUN NO. Outlet HV13

Hercules, Inc Bessemer Ala Run No HV13 1A HV13 1B

	Time	1621		
	Flask Number	14	16	
V_f	Volume of Flask and Valve, ml	2124	2071	
V_a	Volume of Absorbing Reagent, ml	25	25	
V_n	Volume of Flask minus Reagent, ml	2099	2046	
P_{bi}	Initial Barometric Presure, in. Hg	29.71	29.70	
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.40	26.55	
P_i	Initial Absolute Pressure in Flask, in. Hg	3.31		
P_{bf}	Final Barometric Pressure, in. Hg	29.60		
P_{ff}	Final Flask Vacuum in. Hg vac	-1.45		
P_f	Final Absolute Pressure in Flask, in. Hg	28.15		
T_i	Initial Flask Temperature, °F	75	73	
T_{ir}	Initial Flask Temperature, °R	535		
T_f	Final Flask Temperature, °F	73		
T_{fr}	Final Flask Temperature, °R	533		
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, μg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\ (V_n) \left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}} \right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5}) \left[\frac{M}{V_{sc}} \right]$$

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NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 7 MAR 75

RUN NO. HV-13 Outlet

Hercules, Inc. Bessemer Ala Run No.

		HV-13-17	HV-13-18	HV-13-19
	Time	0921	1021	1121
	Flask Number	2	4	6
V_f	Volume of Flask and Valve, ml	2035	2041	1984
V_a	Volume of Absorbing Reagent, ml	25	25	25
V_n	Volume of Flask minus Reagent, ml	2010	2016	1959
P_{bi}	Initial Barometric Presure, in. Hg	29.65	29.63	29.61
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.50	26.45	26.55
P_i	Initial Absolute Pressure in Flask, in. Hg	3.15	3.18	3.06
P_{bf}	Final Barometric Pressure, in. Hg	29.84	29.84	29.84
P_{ff}	Final Flask Vacuum in. Hg vac	-1.45	-0.35	-0.65
P_f	Final Absolute Pressure in Flask, in. Hg	28.39	29.49	29.19
T_i	Initial Flask Temperature, °F	73	73	72
T_{ir}	Initial Flask Temperature, °R	533	533	532
T_f	Final Flask Temperature, °F	64	64	65
T_{fr}	Final Flask Temperature, °R	524	524	525
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, µg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 07 MAR

RUN NO. HV13-Outlet

Hercules Inc Bessemer Ala Run No. HV13-20 HV13-21 HV13-22

	Time	1220	1320	1420
	Flask Number	08	10	12
V_f	Volume of Flask and Valve, ml	2080	2053	2076
V_a	Volume of Absorbing Reagent, ml	25	25	25
V_n	Volume of Flask minus Reagent, ml	2055	2028	2051
P_{bi}	Initial Barometric Presure, in. Hg	29.61	29.60	29.58
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.50	26.45	26.40
P_i	Initial Absolute Pressure in Flask, in. Hg	3.11	3.15	3.18
P_{bf}	Final Barometric Pressure, in. Hg	29.84	29.84	29.63
P_{ff}	Final Flask Vacuum in. Hg vac	-1.75	-0.90	-2.25
P_f	Final Absolute Pressure in Flask, in. Hg	28.09	28.94	27.38
T_i	Initial Flask Temperature, °F	72	73	76
T_{ir}	Initial Flask Temperature, °R	532	533	536
T_f	Final Flask Temperature, °F	65	65	65
T_{fr}	Final Flask Temperature, °R	525	525	525
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, µg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 07 MAR 75

RUN NO. HV-13 Outlet

Hercules Inc Bessemer Ala Run No. HV1323 | HV1324* | HV1325

	Time	1524	1620	1654
	Flask Number	14	16	18
V_f	Volume of Flask and Valve, ml	2124	2071	2078
V_a	Volume of Absorbing Reagent, ml	25	50	25
V_n	Volume of Flask minus Reagent, ml	2099	2021	2053
P_{bi}	Initial Barometric Presure, in. Hg	29.56	29.53	29.54
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.45	26.50	26.45
P_i	Initial Absolute Pressure in Flask, in. Hg	3.11	3.03	3.09
P_{bf}	Final Barometric Pressure, in. Hg	29.82	29.82	29.82
P_{ff}	Final Flask Vacuum in. Hg vac	-2.15	-2.60	-3.70
P_f	Final Absolute Pressure in Flask, in. Hg	27.67	27.22	26.12
T_i	Initial Flask Temperature, °F	77	75	77
T_{ir}	Initial Flask Temperature, °R	533	535	537
T_f	Final Flask Temperature, °F	65	65	65
T_{fr}	Final Flask Temperature, °R	525	525	525
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, μg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

* HV13-24 was charged with 50 ml PDS

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NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 11 MAR 75 Plant Hercules Inc.

RUN NO. Cutbot HV13 Location Bessemer, Ala

	Run No.	HV13-26	HV13-27	HV13-28
	Time	1420	1450	1520
	Flask Number	2	4	6
V_f	Volume of Flask and Valve, ml	2035	2041	1984
V_a	Volume of Absorbing Reagent, ml	25	25	25
V_n	Volume of Flask minus Reagent, ml	2010	2016	1959
P_{bi}	Initial Barometric Presure, in. Hg	29.65	29.65	29.62
P_{fi}	Initial Flask Vacuum, in. Hg vac	27.00	26.85	26.65
P_i	Initial Absolute Pressure in Flask, in. Hg	2.65	2.80	2.97
P_{bf}	Final Barometric Pressure, in. Hg	29.51	29.51	29.53
P_{ff}	Final Flask Vacuum in. Hg vac	+0.50	+0.25	0.00
P_f	Final Absolute Pressure in Flask, in. Hg	30.01	29.76	29.53
T_i	Initial Flask Temperature, °F	74	73	75
T_{ir}	Initial Flask Temperature, °R	534	533	535
T_f	Final Flask Temperature, °F	77	77	78
T_{fr}	Final Flask Temperature, °R	537	537	538
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, μg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 11 MAR 75

RUN NO. HV13 Outlet

Plant Hercules Inc.

Location Bessemer, Ala.

	Run No.	HV13-29	HV13-30 Inlet 12	HV13-31
Time		1521	1620	
Flask Number	7	~~8~~	10	12
V_f Volume of Flask and Valve, ml	2116	2080	2055	2076
V_a Volume of Absorbing Reagent, ml	25	~~25~~	25	25
V_n Volume of Flask minus Reagent, ml	2091	—	2030	2051
P_{bi} Initial Barometric Presure, in. Hg	29.62	~~29.62~~	29.61	29.60
P_{fi} Initial Flask Vacuum, in. Hg vac	26.70	~~26.60~~	26.65	26.70
P_i Initial Absolute Pressure in Flask, in. Hg		2.92	2.96	2.90
P_{bf} Final Barometric Pressure, in. Hg		29.53	29.53	29.55
P_{ff} Final Flask Vacuum in. Hg vac		0.00	+0.70	-4.50
P_f Final Absolute Pressure in Flask, in. Hg		29.53	30.23	25.05
T_i Initial Flask Temperature, °F	77	77	74	75
T_{ir} Initial Flask Temperature, °R		537	534	535
T_f Final Flask Temperature, °F		78	78	77
T_{fr} Final Flask Temperature, °R		538	538	537
V_{sc} Volume of Sample at Dry Std. Cond., ml				
M Mass of NO_2 in Gas Sample, µg				
C Concentration of NO_x as NO_2, dry basis, lb/scf				

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 11 MAR ~~74~~ 75

RUN NO. Outlet HV13

Hercules Inc. Bessemer, Ala. Run No.		HV13-32	HV13 33	~~HV13-34~~
	Time	1721	1750	
	Flask Number	14	16	
V_f	Volume of Flask and Valve, ml	2124	2071	
V_a	Volume of Absorbing Reagent, ml	25	25	~~25~~
V_n	Volume of Flask minus Reagent, ml	2099	2046	
P_{bi}	Initial Barometric Presure, in. Hg	29.60	29.60	
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.60	26.60	
P_i	Initial Absolute Pressure in Flask, in. Hg	3.00	3.00	
P_{bf}	Final Barometric Pressure, in. Hg	29.54	29.50	
P_{ff}	Final Flask Vacuum in. Hg vac	-1.60	+0.50	
P_f	Final Absolute Pressure in Flask, in. Hg	27.94	30.00	
T_i	Initial Flask Temperature, °F	75	75	
T_{ir}	Initial Flask Temperature, °R	535	535	
T_f	Final Flask Temperature, °F	76	77	
T_{fr}	Final Flask Temperature, °R	536	537	
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, μg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 12 Mar 75

RUN NO. Cuthet HV13

Hercules Inc. Bessemer Ala.

	Run No	HV13-34	HV13-35	HV13-36
	Time	1028	1120	1220
	Flask Number	2	4	6
V_f	Volume of Flask and Valve, ml	2035	2041	1984
V_a	Volume of Absorbing Reagent, ml	25	25	25
V_n	Volume of Flask minus Reagent, ml	2010	2016	1959
P_{bi}	Initial Barometric Presure, in. Hg	29.53	29.53	29.55
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.45	26.50	26.50
P_i	Initial Absolute Pressure in Flask, in. Hg	3.08	3.03	305
P_{bf}	Final Barometric Pressure, in. Hg	29.47	29.47	29.46
P_{ff}	Final Flask Vacuum in. Hg vac	-0.45	-0.65	-0.75
P_f	Final Absolute Pressure in Flask, in. Hg	29.02	2882	2871
T_i	Initial Flask Temperature, °F	77	78	78
T_{ir}	Initial Flask Temperature, °R	537	538	538
T_f	Final Flask Temperature, °F	76	73	71
T_{fr}	Final Flask Temperature, °R	536	533	531
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, μg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\ (V_n) \left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5}) \left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 12 MAR 75

RUN NO. Outlet HU-13

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Hercules Inc. Bessemer, Ala.

	Run No.	HU13-37	HU13-38	HU13-39
	Time	1320	1430	1520
	Flask Number	8	10	12
V_f	Volume of Flask and Valve, ml	2080	2055	2076
V_a	Volume of Absorbing Reagent, ml	~~25~~	25	25
V_n	Volume of Flask minus Reagent, ml		2030	2051
P_{bi}	Initial Barometric Presure, in. Hg	29.55	29.55	29.54
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.55	26.45	26.55
P_i	Initial Absolute Pressure in Flask, in. Hg		310	299
P_{bf}	Final Barometric Pressure, in. Hg		29.41	29.33
P_{ff}	Final Flask Vacuum in. Hg vac		-0.40	-1.60
P_f	Final Absolute Pressure in Flask, in. Hg		29.01	27.73
T_i	Initial Flask Temperature, °F	78	78	77
T_{ir}	Initial Flask Temperature, °R		538	537
T_f	Final Flask Temperature, °F		71	75
T_{fr}	Final Flask Temperature, °R		531	535
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, µg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$V_n = V_f - V_a$ $\qquad V_{sc} = (17.71)(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$

$P_i = P_{bi} - P_{fi}$

$P_f = P_{bf} - P_{ff}$ $\qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$

HU13-37 Not Charged w/PDS

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 12 MAR 75

RUN NO. HV 13 · Outlet

Hercules, Inc. Bessemer, Ala		HV13-40	HV13-41	HV13
	Time	1620	1720	
	Flask Number	14	16	
V_f	Volume of Flask and Valve, ml	2124	2071	
V_a	Volume of Absorbing Reagent, ml	25	25	25
V_n	Volume of Flask minus Reagent, ml	2099	2046	
P_{bi}	Initial Barometric Presure, in. Hg	29.50	29.18	
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.45	26.40	
P_i	Initial Absolute Pressure in Flask, in. Hg	3.05	3.08	
P_{bf}	Final Barometric Pressure, in. Hg	29.35	29.33	
P_{ff}	Final Flask Vacuum in. Hg vac	-1.05	-0.05	
P_f	Final Absolute Pressure in Flask, in. Hg	28.30	29.28	
T_i	Initial Flask Temperature, °F	77	76	
T_{ir}	Initial Flask Temperature, °R	537	536	
T_f	Final Flask Temperature, °F	70	70	
T_{fr}	Final Flask Temperature, °R	530	530	
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, μg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 13 MAR 75

RUN NO. HV13 Outlet

Hercules, Inc. Bessemer Ala. Run No. HV13-42 | HV13-43 | 44

	Time	1049	1135	1200
	Flask Number	2	4	6
V_f	Volume of Flask and Valve, ml	2035	2041	1984
V_a	Volume of Absorbing Reagent, ml	25	25	25
V_n	Volume of Flask minus Reagent, ml	2010	2016	1959
P_{bi}	Initial Barometric Presure, in. Hg	29.44	29.43	29.41
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.40	26.30	26.25
P_i	Initial Absolute Pressure in Flask, in. Hg	3.04	3.13	3.16
P_{bf}	Final Barometric Pressure, in. Hg	29.59	29.59	29.62
P_{ff}	Final Flask Vacuum in. Hg vac	-1.60	-3.00	-1.85
P_f	Final Absolute Pressure in Flask, in. Hg	27.99	26.59	27.77
T_i	Initial Flask Temperature, °F	70	68	68
T_{ir}	Initial Flask Temperature, °R	530	528	528
T_f	Final Flask Temperature, °F	59	59	59
T_{fr}	Final Flask Temperature, °R	519	519	519
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, μg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 13 March

RUN NO. HV13 - Outlet

Hercules Inc. Bessemer, Ala Run No

		X	HV13 45	HV 13 46
	Time		1325	1535
	Flask Number	6	6 (ES)	10
V_f	Volume of Flask and Valve, ml		2073	2055
V_a	Volume of Absorbing Reagent, ml	25	25	25
V_n	Volume of Flask minus Reagent, ml	2055	2048	2030
P_{bi}	Initial Barometric Presure, in. Hg	29.39	29.39	29.33
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.35	26.35	26.30
P_i	Initial Absolute Pressure in Flask, in. Hg		3.04	3.03
P_{bf}	Final Barometric Pressure, in. Hg		29.65	29.70
P_{ff}	Final Flask Vacuum in. Hg vac		-3.25	-1.45
P_f	Final Absolute Pressure in Flask, in. Hg		26.40	28.25
T_i	Initial Flask Temperature, °F	73	73	73
T_{ir}	Initial Flask Temperature, °R		533	533
T_f	Final Flask Temperature, °F		59	61
T_{fr}	Final Flask Temperature, °R		519	521
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, µg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\ (V_n) \left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}} \right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5}) \left[\frac{M}{V_{sc}} \right]$$

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NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 13 MAR 75

RUN NO. H/13 Outlet

Hercules, Inc. Bessemer, Ala. Run No 47 | 48 | 49

	Time	1635	1735	1850
	Flask Number	12	14	16
V_f	Volume of Flask and Valve, ml	2076	2124	2071
V_a	Volume of Absorbing Reagent, ml	25	25	25
V_n	Volume of Flask minus Reagent, ml	2051	2099	2046
P_{bi}	Initial Barometric Presure, in. Hg	29.32	29.35	29.26
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.30	26.25	26.20
P_i	Initial Absolute Pressure in Flask, in. Hg	3.02	3.10	3.06
P_{bf}	Final Barometric Pressure, in. Hg 29.60	~~29.59~~	29.70	29.70
P_{ff}	Final Flask Vacuum in. Hg vac -3.10	~~-1.60~~	-1.85	-1.75
P_f	Final Absolute Pressure in Flask, in. Hg	2.620	2.785	2.795
T_i	Initial Flask Temperature, °F 69	~~69~~	70	72
T_{ir}	Initial Flask Temperature, °R	529	530	532
T_f	Final Flask Temperature, °F 61	~~59~~	60	60
T_{fr}	Final Flask Temperature, °R	521	520	520
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, μg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 14 MAR 75

RUN NO. Outlet 1/V-13

Hercules, Inc. Bessemer, Ala. Run No. 50 51 52

	Time	0750	0850	951
	Flask Number	2	4	6
V_f	Volume of Flask and Valve, ml	2035	2041	1984
V_a	Volume of Absorbing Reagent, ml	25	25	25
V_n	Volume of Flask minus Reagent, ml	2010	2016	1959
P_{bi}	Initial Barometric Presure, in. Hg	29.59	29.62	29.63
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.50	26.55	26.70
P_i	Initial Absolute Pressure in Flask, in. Hg	3.09	3.07	2.93
P_{bf}	Final Barometric Pressure, in. Hg	29.79	29.79	29.79
P_{ff}	Final Flask Vacuum in. Hg vac	-1.85	-4.10	-2.95
P_f	Final Absolute Pressure in Flask, in. Hg	27.94	25.69	26.84
T_i	Initial Flask Temperature, °F	60	60	60
T_{ir}	Initial Flask Temperature, °R	520	520	520
T_f	Final Flask Temperature, °F	51	51	54
T_{fr}	Final Flask Temperature, °R	511	511	514
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, µg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 14 MAR 75

RUN NO. Outlet HV13

		53		
	Time	1050		
	Flask Number	6 (ES)		
V_f	Volume of Flask and Valve, ml	2073		
V_a	Volume of Absorbing Reagent, ml	25		
V_n	Volume of Flask minus Reagent, ml	2048		
P_{bi}	Initial Barometric Presure, in. Hg	29.66		
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.50		
P_i	Initial Absolute Pressure in Flask, in. Hg	3.16		
P_{bf}	Final Barometric Pressure, in. Hg	29.79		
P_{ff}	Final Flask Vacuum in. Hg vac	-0.20		
P_f	Final Absolute Pressure in Flask, in. Hg	29.59		
T_i	Initial Flask Temperature, °F	59		
T_{ir}	Initial Flask Temperature, °R	519		
T_f	Final Flask Temperature, °F	54		
T_{fr}	Final Flask Temperature, °R	514		
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, µg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 13 MAR 75

RUN NO. Inlet HV 23

Hercules Inc. Bessemer, Ala. Run No

		HV23-1	HV23-2	HV23-3
	Time	1045	1130	1217
	Flask Number	ES 1	ES 2	ES 5
V_f	Volume of Flask and Valve, ml	2092	2041	~~2075~~ 2064
V_a	Volume of Absorbing Reagent, ml	25	25	25
V_n	Volume of Flask minus Reagent, ml	2067	2016	~~2050~~
P_{bi}	Initial Barometric Presure, in. Hg	29.44	29.43	29.41
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.20	26.40	26.35
P_i	Initial Absolute Pressure in Flask, in. Hg	3.24	3.03	3.06
P_{bf}	Final Barometric Pressure, in. Hg	29.56	29.59	29.63
P_{ff}	Final Flask Vacuum in. Hg vac	-0.75	-1.90	-2.20
P_f	Final Absolute Pressure in Flask, in. Hg	28.81	2769	2743
T_i	Initial Flask Temperature, °F	70	68	70
T_{ir}	Initial Flask Temperature, °R	530	528	530
T_f	Final Flask Temperature, °F	59	59	59
T_{fr}	Final Flask Temperature, °R	519	519	519
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, μg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 13 MAR 75

RUN NO. Inlet HV23

HV-23

Hercules, Inc. Bessemer, Ala. Run No.

		4	5	6
	Time	1315	1530	1630
	Flask Number	7	10	11
V_f	Volume of Flask and Valve, ml	2081	2050	2052
V_a	Volume of Absorbing Reagent, ml	25	25	25
V_n	Volume of Flask minus Reagent, ml	2064	2025	2027
P_{bi}	Initial Barometric Presure, in. Hg	29.39	29.32	29.32
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.35	26.25	26.35
P_i	Initial Absolute Pressure in Flask, in. Hg	3.04	3.07	2.97
P_{bf}	Final Barometric Pressure, in. Hg	29.63	29.70	29.70
P_{ff}	Final Flask Vacuum in. Hg vac	-1.10	-1.90	-0.90
P_f	Final Absolute Pressure in Flask, in. Hg	28.53	27.80	28.80
T_i	Initial Flask Temperature, °F	73	73	73
T_{ir}	Initial Flask Temperature, °R	533	533	533
T_f	Final Flask Temperature, °F	59	59	59
T_{fr}	Final Flask Temperature, °R	519	519	519
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, μg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 13 MAR 75

RUN NO. HV23 Inlet

Hercules Inc. Bessemer Ala. Run No		HV23-7	HV23-8	HV23
	Time	1730	1845	
	Flask Number	12	17 (11)	
V_f	Volume of Flask and Valve, ml	2067	2073	
V_a	Volume of Absorbing Reagent, ml	25	25	
V_n	Volume of Flask minus Reagent, ml	2042	2048	
P_{bi}	Initial Barometric Presure, in. Hg	29.36	29.26	
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.40	~~26.20~~ 26.20	
P_i	Initial Absolute Pressure in Flask, in. Hg	2.96	3.06	
P_{bf}	Final Barometric Pressure, in. Hg	29.70	29.70	
P_{ff}	Final Flask Vacuum in. Hg vac	-1.05	-1.05	
P_f	Final Absolute Pressure in Flask, in. Hg	28.65	28.65	
T_i	Initial Flask Temperature, °F	70	72	
T_{ir}	Initial Flask Temperature, °R	530	532	
T_f	Final Flask Temperature, °F	58	58	
T_{fr}	Final Flask Temperature, °R	518	518	
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, µg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\,(V_n)\left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}}\right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5})\left[\frac{M}{V_{sc}}\right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 14 Mar 75

RUN NO. Inlet HV23

Hercules Inc Bessemer, Ala. Run No.

		9	10	11
	Time	0745	845	945
	Flask Number	1 (ES)	2 (ES)	5
V_f	Volume of Flask and Valve, ml	2092	2041	2064
V_a	Volume of Absorbing Reagent, ml	25	25	25
V_n	Volume of Flask minus Reagent, ml	2067	2016	2039
P_{bi}	Initial Barometric Presure, in. Hg	29.59	29.62	29.63
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.45	26.35	26.50
P_i	Initial Absolute Pressure in Flask, in. Hg	3.14	3.27	3.13
P_{bf}	Final Barometric Pressure, in. Hg	29.79	29.79	29.79
P_{ff}	Final Flask Vacuum in. Hg vac	-0.45	-3.20	-4.00
P_f	Final Absolute Pressure in Flask, in. Hg	29.34	26.59	25.79
T_i	Initial Flask Temperature, °F	60	60	60
T_{ir}	Initial Flask Temperature, °R	520	520	520
T_f	Final Flask Temperature, °F	51	51	54
T_{fr}	Final Flask Temperature, °R	511	511	514
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, μg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\ (V_n) \left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}} \right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5}) \left[\frac{M}{V_{sc}} \right]$$

NITROGEN DIOXIDE SAMPLING DATA AND CALCULATIONS

DATE 14 MAR 74

RUN NO. HV-23 Duct

Hercules Inc. Bessemer, Ala. Run No 12

	Time	1045		
	Flask Number	7 ES		
V_f	Volume of Flask and Valve, ml	2099		
V_a	Volume of Absorbing Reagent, ml	25		
V_n	Volume of Flask minus Reagent, ml	2074		
P_{bi}	Initial Barometric Presure, in. Hg	29.66		
P_{fi}	Initial Flask Vacuum, in. Hg vac	26.60		
P_i	Initial Absolute Pressure in Flask, in. Hg	3.06		
P_{bf}	Final Barometric Pressure, in. Hg	29.79		
P_{ff}	Final Flask Vacuum in. Hg vac	-0.40		
P_f	Final Absolute Pressure in Flask, in. Hg	29.39		
T_i	Initial Flask Temperature, °F	59		
T_{ir}	Initial Flask Temperature, °R	519		
T_f	Final Flask Temperature, °F	55		
T_{fr}	Final Flask Temperature, °R	515		
V_{sc}	Volume of Sample at Dry Std. Cond., ml			
M	Mass of NO_2 in Gas Sample, μg			
C	Concentration of NO_x as NO_2, dry basis, lb/scf			

$$V_n = V_f - V_a \qquad V_{sc} = (17.71)\ (V_n) \left[\frac{P_f}{T_{fr}} - \frac{P_i}{T_{ir}} \right]$$

$$P_i = P_{bi} - P_{fi}$$

$$P_f = P_{bf} - P_{ff} \qquad C = (6.2 \times 10^{-5}) \left[\frac{M}{V_{sc}} \right]$$

APPENDIX F

LABORATORY REPORT FOR EPA METHOD NO. 7 TESTS AND ANALYTICAL REPORT FOR NO_2 CALIBRATION GASES

AIR AND WATER
SAMPLING, ANALYSIS

COMMONWEALTH LABORATORY
INCORPORATED

CHEMISTS BUILDING, 2209 EAST BROAD STREET
RICHMOND, VIRGINIA 23223

P. O. BOX 8025
AREA CODE 804
TELEPHONE: 648-8358

April 3, 1975

No. 75-102-04

CERTIFICATE OF ANALYSIS

One hundred and twenty-nine (129) samples taken at Hercules, Inc.; Bessemer, Alabama; received March 18, 1975.

Attn: Mr. J. T. Chehaske

Job No. 1850, Task Order No. 2

Method: Federal Register, Vol. 36, No. 159, August 17, 1971, Method 7.

SAMPLE IDENTIFICATION	TOTAL μg NO_2
Cal Gas Blank	0
Cal Gas No. 1	6,250
Cal Gas No. 2	13,350
Cal Gas No. 3	12,750
Cal Gas No. 4	142
Cal Gas No. 5	138
Cal Gas No. 6	142
HV-12 Inlet	
Blank, March 05	0
1	7,550
2	6,550
3	8,900
4	7,650
5	10,500
6	10,500
7	10,650
8	7,200
9	6,850
10	7,250
11	9,900
12	11,850
13	8,350
14	10,150
15	9,100
16	6,900
17	6,850
18	5,900
19	11,200
20	14,000
21	8,600

(cont.)

HV-12 Inlet (continued)

SAMPLE I.D.	TOTAL μg NO_2
22	8,200
23	9,000
24	6,850
25	9,800
26	3,650
27	2,300
28	3,650
29	4,600
30	2,800
31	3,450
32	5,150
33	4,750
34	4,750
35	9,000
36	8,550
37	9,500
38	8,150
39	9,550
40	9,600
41	8,150
42	3,750
43	5,500
44	9,750
45	11,000
46	7,200
47	5,550
48	9,350
49	10,450
50	11,000
51	9,500
52	13,150
53	9,550
Blank March 11	0
Blank March 15	0
Blank March 13	0

Outlet HV-13	TOTAL μg NO_2
1	355
2	380
3	450
4	237
5	265
6	244
7	295
8	470
9	506
10	336
11	167
12	280
13	354
14	540
15	235
16	330
Blank March 06	0
17	118
18	103
19	466
20	522
21	200
22	265
23	208
24	420
25	290
26	135
27	30
28	38
29	340
30	122
31	68
32	78
33	90
34	180
35	165
36	210
38	158
39	159
40	295
41	351
42	140
43	114

Outlet HV-13 (continued)

	TOTAL μg NO_2
Blank March 12	0
44	206
45	354
46	197
47	316
48	158
49	308
50	225
51	281
52	634
53	820

HV-23 Demister Inlet

1	7,150
2	5,150
3	10,250
4	13,150
5	8,250
6	10,150
7	12,000
8	11,650
9	11,000
10	11,500
11	7,750
12	10,250

Respectfully submitted,

John A. Bingham

John A. Bingham
Chemist

AIRCO Industrial Gases

P.O. DRAWER NO. 272, UNION LANDING & RIVER ROADS, RIVERTON, NEW JERSEY 08077
TELEPHONE: 609-829-7878

Rare & Specialty Gases Department

April 16, 1975
RSG-75-86

Engineering Sciences, Inc.
7903 West Park Drive
McClean, Virginia 22101

Attention: Mr. John Greenberg

Dear Mr. Greenberg:

The following results on the initial analysis made on the two cylinders we sent you are from our laboratory analytical sheet and are the correct results. There were numerical errors on the tags you received. We are sorry if this caused you any problems in your work.

	Cyl. No.	Test No.	NO_2	NO	N_2	Date
Initial Analysis	MM-2457	U-0219	31.0 PPM	1.5 PPM	Bal.	1/28/7
Reanalysis	"	"	32.0 PPM	0.5 PPM	"	4/14/7
Initial Analysis	MM-2510	U-0218	3980 PPM	20.0 PPM	"	1/28/7
Reanalysis	"	"	3910 PPM	30.0 PPM	"	4/14/7

Very truly yours,
AIRCO INDUSTRIAL GASES

Frank Kramer

Frank Kramer
Chief Laboratory Analyst
Rare & Specialty Gases Dept.

FK/jh

RECEIVED
APR 24 1975
ENGINEERING SCIENCES, INC.

APPENDIX G

PROCESS DATA

PURASIV-N PROCESS DATA

DATE 3/5/75

PLANT Hercules Inc., Bessemer, Ala.

FUEL OIL TANK LEVEL 71 in. AT 1300 HRS.

TIME	FEED GAS		INLET GAS		OUTLET GAS		REGENERATION GAS					BED ΔP in. W.C.	WATER METER READING	[illegible] °F
	PRESS. (PI-131) psig	TEMP. (T-3) °F	FLOW (FR-101) scfm	TEMP (TR-117) (#5) °F	PRESS. (PI-100) psig	TEMP. (TT-101) °F	FLOW (FRC-102) scfm	TEMPERATURE, °F IN (TR-124) (#10)	TEMPERATURE, °F TOP OF BED (#4 & 9)	TEMPERATURE, °F OUT (TR-123) (#11)	PRESS IN (PI-101) psig			
0930	80		6000	50	76		1030	50			125	68	-	30
1030	80		5900	50	76		1030	430			125	67	-	30
1130	82		5900	42	78		1030	150			125	64	-	30
1230	82		4850	38	78		1025	42			124	44	-	29
1330	83		5700	40	78		1025	45			124	59	-	29
1430	82		5950	42	78		1025	370			122	57	-	29
1530	81		5700	41	77		1025	437			122	51	-	29
1630	83		5700	43	79		1025	48			123	51	-	30
1730	81		5650	42	77		1025	47			122	51	-	30

ENGINEERING-SCIENCE, INC.

PROJECT EPA-LAE JOB NO. 1850 DATE 3/5/75 SHT. 1

DETAIL HERCULES HNO_3 TESTING BY JTG OF 16

NITRIC ACID PROCESS DATA

DATE 3/5/75

PLANT Hercules, Inc., Bessemer, Ala.

TIME	AIR FLOW (x 4500 = CFH)	AIR RECEIVER PRESS. psig	SYSTEM PRESS psig	BACK PRESS psig	X. D. R. RPM	INJECTION WATER gpm	ACID STRENGTH Tray #/%	X. R. D. FEED GAS % O_2	PRODUCT STRENGTH %
1430	79	116	112	78	170				
1530	78	116	112	[illegible]	170				
1630	78	116	112	78	170				
1730	78	116	112	78	[illegible]				
1830	80	115	111	76	170				

ENGINEERING-SCIENCE, INC.

PROJECT EPA-106 JOB No. 1550 DATE 3/5/75 SHT. 2

DETAIL HERCULES HNO_3 TESTING BY JG OF 16

PURASIV-N PROCESS DATA

DATE 3/6/75

PLANT Hercules Inc., Bessemer, Ala.

FUEL OIL TANK LEVEL _____

TIME	FEED GAS		INLET GAS		OUTLET GAS		REGENERATION GAS					BED ΔP	WATER METER READING	[illegible]
	PRESS. (PI-131) psig	TEMP. (T-3) °F	FLOW (FR-101) scfm	TEMP (TR-117) (#5) °F	PRESS. (PI-100) psig	TEMP. (TI-107) °F	FLOW (FRC-102) scfm	TEMPERATURE, °F IN (TR-124) (#10)	TEMPERATURE, °F TOP OF BED (#4 & 9)	TEMPERATURE, °F OUT (TR-123) (#11)	PRESS IN (PI-101) psig	in. W.C. / bypass valve pos.		°F (TI-111)
0800	84	75	6050	47	79	75	1005	45	110	107	124	60.5	-	32
0900	84	76	5900	47	79	73	1045	45	365	205	-	56.0	-	32
1000	84	76	5950	45	78	75	1050	44	63	100	124	58.0	-	28
1100	84	76	5750	40	77	68	1055	432	58	63	124	60.5/C	-	28
1200	82	78	5750	45	77	73	1040	55	192	132	123	60.5/C	-	31
1300	80	80	5700	45	74	76	1025	51	370	222	120	60.5/C	-	32
1400	85	81	5650	45	77	77	1050	50	65	115	125	56.0/C	-	32
1500	85	81	5850	45	79	73	1040	443	95	75	125	54.0/18	-	32
1600	84	83	5850	47	78	73	1035	92	115	115	124	54/18	-	34
1700	85	82	5825	47	79	73	1025	50	355	178	125	54/18	-	34
1800	92	75	5600	42	84	62	1015	50	65	110	128	45/18	-	28
1900			580				1045							
2000			580				1045							
2100			580				1045							
2200			650				1060							
2300			820				1050							
M.N.														

ENGINEERING-SCIENCE, INC.

PROJECT EPA-ICE JOB NO. 1850 DATE 3/6/75 SHT. 3

DETAIL HERCULES HNO_3 TESTING BY JTG OF 16

NITRIC ACID PROCESS DATA

DATE 3/6/75

PLANT Hercules, Inc., Bessemer, Ala.

TIME	AIR FLOW (X 4500 = CFH)	AIR RECEIVER PRESS. psig	SYSTEM PRESS psig	BACK PRESS psig	X. D. R. RPM	INJECTION WATER gpm	ACID STRENGTH Tray #/%	XRD. FEED GAS %O_2	PRODUCT STRENGTH %
0800	82	118	114	78	170		29/08.8 26/12.2		60.06
0900	81	118	114	78	170		16/43.5 4/59.87		
1000	81	118	114	79	170		{29/10.6, 26/14.5, 16/47.4, 4/58.42		59.68
1100	81	117	113	78	171				
1200	80	115	111	76	170	2.70			
1300	80	114	110	75	170	2.65	{29/10.6, 26/14.5, 16/49.0, 4/58.44	2.2	59.68
1400	78	117	113	80	168	2.65	29/13.1	2.7	59.42
1500	77	117	113	80	168	2.60		2.9	
1600	77	116	112	80	168	2.55	29/15.4, 26/21.6, 16/57.1, 4/59.78	3.0	59.68
1700	77	116	112	80	168	2.55		3.1	
1800	70	119	115	86	136	2.55		2.6	

ENGINEERING-SCIENCE, INC.

PROJECT EPA-LOE JOB No. 1850 DATE 3/6/75 SHT. 4

DETAIL HERCULES HNO_3 TESTING BY JTG OF 16

PURASIV-N PROCESS DATA

DATE 3/7/75

PLANT Hercules Inc., Bessemer, Ala.

FUEL OIL TANK LEVEL 68" @ 1700

	TIME	FEED GAS		INLET GAS		OUTLET GAS		REGENERATION GAS					BED ΔP	WATER METER READING	BRINE TEMP
		PRESS. (PI-131) psig	TEMP. (T-3) °F	FLOW (FR-101) scfm	TEMP (TR-117) (#5) °F	PRESS. (PI-100) psig	TEMP. (TI-109) °F	FLOW (FRC-102) scfm	TEMPERATURE, °F IN (TR-123) (#10)	TEMPERATURE, °F TOP OF BED (#4 & 9)	TEMPERATURE, °F OUT (TR-125) (#11)	PRESS IN (PI-107) psig	in. W.C. / Bypass Valve press		°F
	MN			825				1050							
	0100			830				1040							
	0200			830				1030							
	0300			780				1030							
	0400			790				1010							
	0500			0				0							
	0600			0				0							
	0700			0				0							
A	0800			600				1015					15		
B	0900	83	75	5700	42	78	56	1015 ~~5700~~	250	55	62	124	50/18	–	30
B	1000	–	–	4500	42	–	–	1010	440	110	70	–	29/18	–	–
B	1100	80	80	5700	42	76	75	1010	55	220	145	121	51/18	–	34
B	1200	82	82	5750	45	77	75	1010	55	368	255	122	52/18	–	35
A	1300	82	82	5550	45	77	73	1010	200	57	77	122	55/18	–	35
A	1400	83	83	5700	45	78	71	1020	445	105	85	123	57/18	–	35
	1527	88	86	5500	48	80	73	1300	60	370	155	126	58/18	–	38
	1630	88	81	5600	45	81	61	1150	50	60	135	125	57/18	–	34
	1710	86	85	5850	50	80	65	1020	360	65	75	127	54/18	–	35

ENGINEERING-SCIENCE, INC.

PROJECT EPA-LOE JOB NO. 1850 DATE 3/7/75 SHT. 5

DETAIL HERCULES HNO_3 TESTING BY JTG OF 16

NITRIC ACID PROCESS DATA

DATE 3/7/75

PLANT Hercules, Inc., Bessemer, Ala.

TIME	AIR FLOW (X 4500 = CFH.)	AIR RECEIVER PRESS. psig	SYSTEM PRESS psig	BACK PRESS psig	X. D. R. RPM	INJECTION WATER gpm	ACID STRENGTH Tray #/%	X.R.D. FEED GAS % O_2	PRODUCT STRENGTH %
M.N.	60	120	116	90 ~~83~~	130	2.0	29/12.2, 26/17.0, 16/53.0, 4/60.2	3.7	59.70
0100	60	120	116	90	130	2.0			
0200	60	120	116	90	130	2.0			
0300	60	120	116	90	130	2.0	29/9.7, 26/13.1, 16/48.1, 4/58.97	3.7	60.53
0400	60	120	116	90	130	2.0			
0500	0								
0600	50								
0700	46								
0800	50								
0900	75	117	113	80	158	2.7	29/6.2, 26/8.8, 16/27.0, 4/57.84		58.18
1000	73 → 0 → 35 in 5 min.								
1100	73	116	111	77	149	2.45		0.9	
1200	73	116	111	77	149	2.45		1.35 ~~1.4~~	
1300	74	116	112	78	159	2.50	29/10.6, 26/14.5, 16/44.3, 4/~~[illegible]~~ 58.32	1.70	57.76
1400	75	113	110	78	160	2.50		4.35	
1527	74	114	111	82	160	2.45		3.95	
1630	74	116	112	82	160	2.45	29/12.2, 26/17.8, 16/[illegible]	3.72	
1710	73	117	114	82	160	2.45		4.30	57.76

ENGINEERING-SCIENCE, INC.

PROJECT EPA-LOE JOB NO. 1860 DATE 3/7/75 SHT. 6

DETAIL HERCULES HNO3 TESTING BY JTG OF 16

PURASIV-N PROCESS DATA

DATE 3/10/75

PLANT Hercules Inc., Bessemer, Ala.

FUEL OIL TANK LEVEL 66 1/2" @ 13:30

TIME	FEED GAS		INLET GAS		OUTLET GAS		REGENERATION GAS					BED ΔP in. WC	WATER METER READING	PROD TEMP °F
	PRESS. (PI-131) psig	TEMP. (T-3) °F	FLOW (FR-101) scfm	TEMP (TR-117) (#5) °F	PRESS. (PI-106) psig	TEMP. (TI-108) °F	FLOW (FRC-102) scfm	TEMPERATURE, °F IN (TR-122) (#10)	TOP OF BED (#4 & 5)	OUT (TR-123) (#11)	PRESS IN (PI-101) psig			

PURASIV NOT STARTED

ENGINEERING-SCIENCE, INC.

PROJECT EPA-LDE JOB NO. 1850

DETAIL HERCULES HNO_3 TESTING

DATE

BY

SHT. 7 OF 16

NITRIC ACID PROCESS DATA

DATE 3/10/75

PLANT Hercules, Inc., Bessemer, Ala.

TIME	AIR FLOW (X 4500 = CFH)	AIR RECEIVER PRESS. psig	SYSTEM PRESS psig.	BACK PRESS psig	X. D. R. RPM	Injection Water gpm	Acid STRENGTH Freq #/%	X.R.D Tail Gas % O_2	Product Strength %
1600	20	127	94	80	30	3.5	—	—	—
16:40	36	116	110	80	67	1.2	-	3.2	—

Plant continued to run until 07:00 on 3/11/75
Purasiv was not used

ENGINEERING-SCIENCE, INC.

PROJECT EPA-LOE JOB NO. 1550 DATE 3/10/75 SHT. 8

DETAIL HERCULES HNO_3 TESTING BY RXR OF 16

PURASIV-N PROCESS DATA

DATE 3/11/75

PLANT Hercules Inc., Bessemer, Ala.

FUEL OIL TANK LEVEL 67" @ 17:30

TIME	FEED GAS		INLET GAS		OUTLET GAS		REGENERATION GAS					BED ΔP in. W.C.	WATER METER READING	[illegible] TEMP °F
	PRESS. (PI-131) psig	TEMP. (T-3) °F	FLOW (FR-101) scfm	TEMP (TR-117) (#5) °F	PRESS. (PI-102) psig	TEMP. (TI-101) °F	FLOW (FRC-102) scfm	TEMPERATURE, °F IN (TR-122) (#10)	TOP OF BED (#4 & 9)	OUT (TR-123) (#11)	PRESS IN (PI-101) psig			
1400	86	74	3200	40	75	66	1030	395	42	50	130	68/12	6.69 / 14:03	30
1445	97	74	4400	40	83	56	1040	412	40	58	130	52/18	5141 / 14:52	30
1530	90	77	5200	40	80	56	1030	418	41	98	126	70/18	8130 / 15:31	29
1615	90	79	5200	40	80	58	1030	47	45	185	125	70/10	11,565 / 16:15	30
1700	90	79	5200	40	80	62	1030	45	48	242	125	70/15	15,480 / 17:22	30
B 1800	90	81	5400	40	80	57	1030	110	56	90	127	70/18	18,850 / 17:45	30
1900														
2000	89	74	5400	50			1030	60				70		30
2100														
2200	89	77	5300	50			1020	280				70		30
2300														
2400	88	81	5100	45			1020	50				72		32

ENGINEERING-SCIENCE, INC.

PROJECT EPA-LDE JOB NO. 1850 DATE 3/11/75 SHT. 9

DETAIL HERCULES HNO_3 TESTING BY OF 16

NITRIC ACID PROCESS DATA

DATE 3/11/75

PLANT Hercules, Inc., Bessemer, Ala.

	TIME	AIR FLOW (x 4500 = CFM)	AIR RECEIVER PRESS. PSIG	SYSTEM PRESS PSIG	BACK PRESS PSIG	X. D. R. RPM	Injection water gpm	Acid Strength Tray# / %	X.R.D. Feed Gas % O_2	Product Strength %
	1300	Light	OFF	[Start	- UP]					
A	1400	34	118	96	76	78	0.8		2.55	1403/604
	1445	36	118	112	94	82	1.3		3.42	
	1530	62	120	114	85	134	1.85		4.0	
	1615	60	116	112	84	134	1.8	29/4.2 26/7.1	3.5	58.5
	1700	60	116	112	84	134	2.1	16/21.6 4/56.95	3.7	
B	1800	60	116	112	84	134	2.1		3.6	
	1900	60	118	114	84	134	2.2			
	2000	60	116	112	84	134	2.0	29/7.1 26/9.7 16/33.7 4/57.78		58.18
	2100	60	116	112	84	134	2.0			
	2200	60	116	112	84	134	2.0			
	2300		116	112	84	134	2.0			
	2400		116	112	84	136	2.0	29/9.7 26/14.7 16/40.4 4/57.51		58.98

ENGINEERING-SCIENCE, INC.

PROJECT EPA-LOE JOB NO. 1550 DATE 3/11/75 SHT. 10

DETAIL HERCULES HNO_3 TESTING BY OF 16

PURASIV-N PROCESS DATA

DATE 3/12/75

PLANT Hercules Inc., Bessemer, Ala.

FUEL OIL TANK LEVEL _____

Time	H_2O meter Reading
09:00	98,030
14:11	129,610
17:00	138,830

	TIME	FEED GAS		INLET GAS		OUTLET GAS		REGENERATION GAS					BED ΔP in. W.C.	WATER METER READING	BRINE TEMP °F
		PRESS. (PI-131) psig	TEMP. (T-3) °F	FLOW (FR-101) scfm	TEMP (TR-117) (#5) °F	PRESS. (PI-106) psig	TEMP. (TI-107) °F	FLOW (FRC-102) scfm	TEMPERATURE, °F IN (TR-124) (#10)	TOP OF BED (#4 & 4)	OUT (TR-123) (#11)	PRESS IN (PI-101) psig			
	1:00			5200	10.0			1020					70/		
B	2:00	88	82	5200	40			1020	300				70/		32
	3:00			5200				1020					70/		
	4:00	88	82	5200	45			1020	60				70/		34
	5:00			5200				1020					70/		
A	6:00	88	82	5200	45			1020	50				70/		34
	7:00			4200				1020					52/		
	8:00	98	79	4200	42	84	67	1020	48	50	197	130	52/18		32
	9:00	98	79	4200	41	84	68	1020	48	50	240	130	52/18		32
B	10:00	99	80	4350	42	84	62	1030	160	50	90	132	50/18		32
	11:00	98	81	4350	41	84	68	1030	428	35	62	132	50/18		32
	12:00	98	83	4300	42	84	68	1030	65	35	108	132	50/18		34
	13:00	98	85	4300	43	84	67	1030	50	35	250	132	50/18		34
A	14:00	90	86	5250	47	80	64	1020	50	39	98	124	69/18		36
	1600	90	81	5100	42	80	72	1020	438	48	62	126	70/18		32
	16:00	90	83	5000	44	80	72	1020	68	48	108	126	70/18		32
	17:00	90	85	5000	45	81	72	1030	50	52	250	126	70/18		34
B	18:00	88	84	5050	45	80	73	1020	49	50	122	124	70/18		34
	1900													-	
	2000	98	82	4300	45			1020	55				44	-	31
	21:00													-	
	22:00	98	82	4200	45			1020	50				44	-	32
	2300													-	
	2400	98	85	4300	50			1020	70				44	-	34

ENGINEERING-SCIENCE, INC.

PROJECT EPA-LDE JOB NO. 1550 DATE 3/12/75 SHT. 11

DETAIL HERCULES HNO_3 TESTING BY RLR OF 16

NITRIC ACID PROCESS DATA

DATE 3/12/75

PLANT Hercules, Inc., Bessemer, Ala.

TIME	AIR FLOW (x 4500 = CFH)	AIR RECEIVER PRESS. psig	SYSTEM PRESS psig.	BACK PRESS psig	X. D. R. RPM	Injection Water gpm	Acid Strength Tray*/%	X.R.D Feed Gas P_2O_5	Product Strength %
1:00	60	114	110	83	136	2.0			
2:00	60	116	112	84	136	2.0			
3:00	60	116	112	84	136	2.0	29/13.1 16/52.2 26/17.8 4/59.03		59.02
4:00	60	114	110	84	136	2.0			
5:00	60	114	110	83	136	2.0	29/16.2 26/20.9 16/54.7 4/59.24		59.28
6:00	60	114	110	83	136	2.0			
7:00	40	114	110	83	88	2.0	29/17.0 26/27.3 16/55.6 4/59.29		59.48
8:00	36	116	114	94	88	1.9		3.15	
9:00	36	116	114	94	88	1.8		3.1	
10:00	36	117	114	98	88	1.8	29/9.7 26/15.9 16/52.8 4/60.07	2.8	60.25
11:00	36	118	116	96	88	1.8		2.2	
12:00	36	116	114	94	89	1.8		2.1	
13:00	36	116	114	94	88	1.8	29/10.6 26/15.4 16/51.9 4/59.31	2.1	59.97
14:00	62	116	112	84	140	2.2		2.8	
15:00	58	116	112	84	140	2.2		2.9	
16:00	58	116	112	84	140	2.3	29/13.1 26/18.6 16/59.96 4/60.94	2.8	59.97
17:00	58	116	112	84	138	2.3		3.5	
18:00	57	114	110	83	128	2.3		3.2	
19:00	58	116	112	83	132	2.0			
20:00	58	116	112	83	132	2.0	29/11.4 26/15.4 16/49 4/59.30		59.70
21:00	58	116	111	82	132	2.0			
22:00	58	115	111	82	132	2.0			
23:00	56	115	111	82	132	2.0			
24:00	57	114	110	83	128	2.0	29/12.2 26/17.0 16/44.8 4/59.30		58.78

ENGINEERING-SCIENCE, INC.

PROJECT EPA-LOE JOB NO. 1550 DATE 3/12/75 SHT. 12

DETAIL HERCULES HNO_3 TESTING BY RLR OF 16

PURASIV-N PROCESS DATA

DATE 3/13/75

PLANT Hercules Inc., Bessemer, Ala.

FUEL OIL TANK LEVEL _____

	TIME	FEED GAS		INLET GAS		OUTLET GAS		REGENERATION GAS					BED ΔP in W.C.	WATER METER READING	BRINE TEMP °F
		PRESS. (PI-131) psig	TEMP. (T-3) °F	FLOW (FR-101) scfm	TEMP (TR-117) (#5) °F	PRESS. (PI-102) psig	TEMP. (TT-101) °F	FLOW (FRC-102) scfm	TEMPERATURE, °F IN (TR-122) (#10)	TEMPERATURE, °F TOP OF BED (#4 & 9)	TEMPERATURE, °F OUT (TR-123) (#11)	PRESS IN (PI-101) psig			
	1:00													-	
	2:00	88	86	4900	50			1020	50				70	-	35
	3:00													-	
	4:00	88	84	5100	45			1020	440				68	-	35
	5:00			5100				1020						-	
	6:00	88	82	5100	48			1020	70				68	-	34
	7:00														
	8:00	96	75	4200	50	83	68	1030 [redacted]	50	45	112	130	52/19		30
	9:00	100	76	4200	39	86	64	1030	44	48	218	132	52/18		30
B	10:00	100	76	4200	40	84	63	1030	42	42	102	132	52/18		30
B	11:00	100	78	3000	40	85	66	1030	99	38	129	132	38/1		29
	12:00	86	80	5800	42	80	58	1040	415	38	58	125	74/18		30
	13:00	84	81	5800	48	78	72	1030	60	44	102	124	76/14		38
*	14:00	No	Data	Taken	: System	Flooding			*	*	*	*			
A	15:00	86	80	6200	47	78	68	1030	130	60	80	126	60/15		33
	16:00	86	78	6050	42	78	68	1030	408	47	66	126	60/18		32
	17:00	85	80	6150	44	75	65	1030	60	49	102	125	62/14		33
	18:00	82	78	6050	46	78	62	1030	48	52	194	124	60/18		34
B	19:00	82	81	6050	48	74	63	1030	50	50	102	122	60/18		35
	20:00	84	86	6300	50			1020	440				58		31
	21:00														
	22:00	83	86	6300	50			1020	50				56		38
	23:00														
	24:00	84	76	6200	50			1020	430				60		32

ENGINEERING-SCIENCE, INC.

PROJECT EPA-IDE JOB NO. 1850 DATE 3/13/75 SHT. 13

DETAIL HERCULES HNO_3 TESTING BY RLR OF 16

H_2O meter

NITRIC ACID PROCESS DATA

DATE 3/13/75

PLANT Hercules, Inc., Bessemer, Ala.

Time	Reading
09:00	222,850
13:00	241,800
18:00	267,590

TIME	AIR FLOW (X 4500 = CFM)	AIR RECEIVER PRESS. psig	SYSTEM PRESS psig.	BACK PRESS psig	X.D.R. RPM	Injection water gpm	Acid Strength Tray #/20	XRD Feed Gas % SO_2	Product Strength %
1:00	57	114	110	83	132	2.0			
2:00	58	114	110	83	132	2.0			
3:00	57	115	111	83	130	2.0	29/14.5 24/16.6 14/55.6 4/57.50		59.97
4:00	55	115	111	83	130	2.0			
5:00	56	115	111	83	130	2.0	29/15.4 24/19.3 14/56.4 4/60.03		60.53
6:00	56	114	110	83	130	2.0			
7:00	36	114	110	83	82	2.0	29/13.8 24/21.6 14/23.9 4/59.88		60.20
8:00	35	115	112	93	82	1.8		1.9	
9:00	33	120	118	100	82	1.7		3.2	
10:00	35	116	112	96	82	1.8	29/11.4 24/17.0 14/51.4 4/60.73	3.5	60.22
11:00	35	118	115	98	82	1.7		3.1	
12:00	76	116	112	80	158	2.6		3.1	
13:00	73	116	112	80	158	2.5	29/11.4 24/17.0 14/7 4/7	2.8	59.42
* 14:00	Production		Rate	Changing	*	*			
15:00	78	118	114	80	161	2.7		4.2	
16:00	80	121	118	80	164	2.6	29/16.5 24/20.1 14/53.26 4/58.71	2.8	58.11
17:00	80	120	116	78	164	2.7		3.1	
18:00	80	118	114	77	164	2.7		3.0	
19:00	82	118	113	77	164	2.6		3.0	
20:00	82	118	114	76	164	3.0	29/19.3 24/25.0 14/56.86 4/60.13		59.14
21:00	82	118	114	76	164	3.0			
22:00	82	118	114	76	164	3.0			
23:00	82	118	114	76	164	3.0		[redacted]	
24:00	82	120	116	80	168	2.8	29/20.9 24/26.2 14/56.4 4/58.71	[redacted]	59.95

ENGINEERING-SCIENCE, INC.

PROJECT EPA-LOE JOB NO. 1550

DETAIL HERCULES HNO_3 TESTING

DATE 3/13 BY RLR

SHT. 14 OF 16

NITRIC ACID PROCESS DATA

DATE 3/14/75

PLANT Hercules, Inc., Bessemer, Ala.

TIME	AIR FLOW (x 4500 = CFH)	AIR RECEIVER PRESS. psig	SYSTEM PRESS psig	BACK PRESS psig	X. D. R. RPM	Inquition water gpm	Acid Strength Tray #/%	XRD Feed Gas N_2O_2	Product Strength
1:00	83	120	114	80	168	2.8	-	Instrument out of order	
2:00	83	120	116	80	168	2.8			
3:00	84	121	116	80	168	2.8	29/14.5 21/19.3 16/539 4/38.71		59.83
4:00	84	121	116	80	168	2.8			
5:00	85	121	117	80	168	2.8	29/15.4 26/20.1 16/539 4/59.88		59.83
6:00	85	121	117	80	168	2.8			
7:00	85	121	117	80	168	2.8			
8:00	80	118	114	77	168	2.6			
9:00	80	118	114	78	168	2.6			
10:00	80	116	112	76	168	2.6			
11:00	80	116	112	76	168	2.6			

ENGINEERING-SCIENCE, INC.

PROJECT EPA-LOE JOB NO. 1250 DATE 3/14/75 SHT. 15

DETAIL HERCULES HNO_3 TESTING BY RRR OF 16

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PURASIV-N PROCESS DATA

DATE 3/14/75

PLANT Hercules Inc., Bessemer, Ala.

FUEL OIL TANK LEVEL 63 1/2" @ 10:00 AM 3/14/75

Water Meter

Time	Reading (gN)
07:13	331,635
11:00	347,375

TIME	FEED GAS		INLET GAS		OUTLET GAS		REGENERATION GAS					BED ΔP in. W.C.	WATER METER READING	PRIME TEMP °F
	PRESS. (PI-131) psig	TEMP. (T-3) °F	FLOW (FR-101) scfm	TEMP (TR-117) (#5) °F	PRESS. (PI-106) psig	TEMP. (TI-105) °F	FLOW (FRC-102) scfm	TEMPERATURE °F IN (TR-122) (#10)	TEMPERATURE °F TOP OF BED (#4 & 9)	TEMPERATURE °F OUT (TR-123) (#11)	PRESS IN (PI-101) psig			
1:00														
2:00	84	74	6100	45			1020	50				60		32
3:00														
4:00	84	72	6300	40			1020	400				60		30
5:00														
6:00	84	70	6200	45			1030	50				60		30
A 7:00	80	68	5900	44	75	55	1030	45	42	74	120	58/18		31
8:00	83	67	5500	44	78	69	1030	408	48	55	123	60/18		32
9:00	84	66	5500	45	80	71	1030	411	49	102	124	60/18		32
10:00	82	67	5450	44	80	69	1030	48	51	160	122	60/18		31
11:00	82	68	5500	44	78	67	1030	47	49	114	122	60/18		32

ENGINEERING-SCIENCE, INC.

PROJECT EPA-LOE JOB NO. 1850

DETAIL HERCULES HNO_3 TESTING

DATE 3/14/75 BY RKR

SHT. 16 OF 16

0. Compressor #3 off line - output being used by other parts of plant
1. Unit was shut down during the night - pilot flame failure
2. Unit restarted about 7:20 - run at partial load until 0930
3. Switched to adsorber A @ 0930. Brought flow rate thru system up to ~ 6000 scfm.
4. 1135 Acid plant shut down - Purasiv shut off Lost a boiler at the power plant - low steam press to ammonia vaporizer forced shut down

1210 - restarted Purasiv - initial flow 5350, changed to 4800 @ 1230.
1305 - raised Purasiv flow rate to 5700.
1412 - Unit B switched on adsorption mode, fuel flow increased to 5950.
1517 - Started Voltage & amperage Recorder
1520 - Feed rate ~~[illegible]~~ lowered to 5700 scfm (design rate)
1800 - Unit auto. - switched to adsorber A, flow started at 5750
Bed ΔP set point changed to 61.

3/6/75 DAILY LOG Compressor #3 being used by powder line

0800 arrived at plant - plant & Purasiv had operated continuously during the night. Outlet chart recorder had stopped inking at
0830 Purasiv ΔP set point changed from 61 in. W.C. to 56 in. W.C.
Purasiv flow droped from 5900 scfm to 5750 scfm
~~Regen~~ Regen. flow rate changed from 1010 to 1040 scfm
1010 Purasiv auto-switched from A to B on adsorption mode. Bed ΔP jumped from 58 to 60.5.
1035 Inlet flow up to 5750, bed ΔP set point changed from 58.0 to 60.5 in. W.C.
1408 ~~1355~~ Purasiv auto switched to B on adsorption, A on regen.
Inlet flow jumped to 5900 scfm and bed ΔP droped to 56 with no change in the ΔP set point
1709 Failure of push rod linkage on X.R.D. caused plant to shut down for about 5 minutes. Flow to Purasiv was droped but did not shut down until. Plant back in about 20 minutes. Ran up & down for next 20 min
1812 Purasiv auto switched to A adsorption, B regen. New bed ΔP about 46 in. W.C. Inlet flow rate 5250
Plant still lining out
1820 Compressor #6 failed Plant kept running at reduced rate
Inlet flow 575, Regen flow 1050, ΔP 12.5,

ENGINEERING-SCIENCE, INC.	PROJECT BESSEMER HNO_3 JOB NO. 1850	DATE 3/5/75	SHT. 1
	DETAIL DAILY LOG	BY JTC	OF 8

3/6/75 CONT.

1800 to M.N. Continued operating at a reduced rate. Plant running about 60 on air flow chart.

3/7/75

M.N. to 0430 Sieve operated at about 800 scfm inlet and 1020 regen until 0430 when high liquid level in the sieve demister shut the Purasiv down. Attempts by operator to restart were unsuccessful. Plant also down.

0730 Purasiv restarted by Bob Allbright. Plant running about 50 on air flow chart

0830 Plant up to 85 air flow - but then lost something and could only get 75. Plant not sure what is causing lower flow.

0850 auto sieve change to B on adsorb, A on regen.

1000 Compressor #6 kicked off - air flow to plant off for a min or so - plant brought back up immediately. Purasiv flow maintained although at reduced rate of 4500 for about 25 min - then back up to 5700.

1255 Purasiv auto switch to A on adsorb., B on regen. Flow before switch was 5800 scfm, regen 1010 scfm. After switch inlet

1308 Increased air flow to bleacher to get more O_2 into tower. Total air flow went from 73 to 77 on chart. Purasiv inlet went from 5550 to 5650, regen from 1010 to 1020. O_2 in tail gas went from 1.70 to 3.3%

1655 PuraSiv auto switch to B on adsorb, A on regen

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	DETAIL HERCULES HNO3 TESTS	BY 7-76	OF 8

3/10/75 - Daily Log - R.L. Roberson

Arrived at plant approx 8:00 AM. Review data to be taken and locations of various meters.
Port for water meter is expected around 13:00.

09:45 Waiting for plant to come on-line.
Delay - for NH_3 pressure to build in feed tanks

11:00 Pressure Rising very slowly in NH_3 - Tank #3

14:00 Pressure at 145 psig in Tank #3
Plant has decided to try to raise sufficient feed pressure in Tank #4. Will light off on #4 & switch to #5

Note: The NH_3 pressure in feed (supply) tanks must be 165 psig because
1) NH_3 must be a gas when it goes into burner
2) NH_3 pressure must be greater than the combustion air pressure, else there would be "blow-back" into receiver

15:10 NH_3 Combustor is lighted

16:00 Acid being made, as system smooths out the Pura Siv will be purged.

16:20 Purging began, Will require at least one (1) hour.

16:45 Pura Siv not started because of thermocouple failure in the heater unit of the Siv. Thus, flame could not be stabalized.

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	DETAIL Hercules HNO_3 Tests	BY RdR	OF 8

3-11-75 Daily Log

07:10 Unit shut down to repair leak in discharge line from oxidizing unit

08:15 Begin to remove line with leak (bad weld)

08:30 Estimated start-up time ≅ 10:30

13:00 Leak repaired, other minor repairs completed
Combustor Ignited.

14:00 PuraSiv Cycle Began
Adsorber - A

One Air compressor with a 1300 cfm capacity is down. This reduces production rate - the ~~cm~~ compressor may be down for the rest of the week. At this lower production rate, the Adsorption tower is much more efficient and thus lower inlet concentrations are to be expected!

15:~~20~~ 30 An Auxiliary compressor with 600 cfm capacity was brought online. This will increase production rate

16:30 Process appears to have leveled-out.
Data to be taken hourly

17:10 No Acid samples have been taken. It takes ≈ until 4pm, 4 hrs. after start-up for acid to get up to strength.

17:54 Cycle over ⇒ Adsorption B

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	Detail Hercules HNO3 Tests	By QSR	of 8

3-12-75 Daily Log

07:00 The auxiliary compressor was taken off line. Actually, this compressor is still running but its air (output) belongs to another part of the plant. Thus, the AOP will be at less than rated capacity for all of the 2nd shift (7am-3pm).

10:02 Vessel B ADSORBING

11:00 Bob Albright reports that the #6 compressor may be online by Noon 3/13 (Thur.) This would put the plant close to capacity

13:45 Auxiliary Compressor put on line. This is the #3 compressor which adds about 600 cfm.

14:03 Cycle Change - VESSEL A ADSORBING

18:06 Cycle Change - VESSEL B ADSORBING

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	DETAIL Hercules HNO3 Tests	BY RLR	OF 8

3-13-75 Daily Log

6:45 No. 3 Compressor shunted back to power house. Thus, Production Rate dropped.

10:16 CYCLE CHANGE VESSEL B ADSORDING

10:28 Flame FAILURE in Heater (Regen cycle for vessel A)

10:40 By-Pass open, flow thru Sieve dropped to 3000 cfm. Differential pressure down to 38/1 By-Pass should be wide open

11:15 Flame still out, continuing to Bypass Sieve

11:30 Compressor No. 6 has been repaired and is running. The production rate will increase
Air flow is reading 74 (x4500) cfh
X.R.D Speed = 174 rpm
Flow thru Sieve is up to 5300 cfm
By pass closing ⇒ Flame lighted

11:32 Sieve flow increased to 5800 cfm but falling off!

11:33 Discover loose line on X.R.D (Power Recovery)
Its speed has dropped to 136 rpm
Problem: Broken valve connection on XRD.

11:36 Alarm X.R.D Down, Air Flow and production dropping
XRD intake valve must be repaired
Flow thru Sieve = 3000 cfm

11:41 X.RD repaired and back on-line. Should get up to rate if nothing else happens

3-13-75 Continued

11:45 AOP is beginning to approach rate
Flow thru Sieve 6200 cfm.
The flame was ignited ≈ 11:30.
PuraSieve reset to automatic and cycle will continue.

12:55 Plant operating smoothly. This is the first time the plant has approach rate this week (10 March 75)

13:55 No. 3 Compressor put on line. This should give max. rate

13:59 High diff pressure alarm in ADSORBTION TOWER.
14:00 By-Pass open (Auto UWD is not openning thus creating High ΔP in tower)

14:10 B. Albright is not sure why, but the regen flow began to fluctuate between 600 – 1350 scfm.
PuraSieve ΔP ≈ 22 in W.C. ; Bypass is fully open

1455 – PuraSieve began to settle down, Production rate was slightly reduced

15:03 CYCLE CHANGE : VESSEL A ADSORBING

16:24 Alarm : High ΔP in adsorption tower. This is the same problem that occured at 14:00. Corrected w/ no problem for PuraSieve

19:05 CYCLE CHANGE : VESSEL B ADSORBING

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	DETAIL Hercules, HNO3 Testing	BY RRR	OF 8